THE BOOK of KNOWLEDGE

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The
BOOK *of* KNOWLEDGE

The Children's Encyclopedia

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DEPARTMENTS

The Earth
Stories and Legends
All Countries
Golden Deeds
Helps to Learning
Literature
Animal Life
Famous Books
Dominion of Canada
The United States
Familiar Things
Our Own Life
The Fine Arts
Men and Women
Poetry and Rhymes
Plant Life
Things to Make
and Things to Do
Book of Wonder

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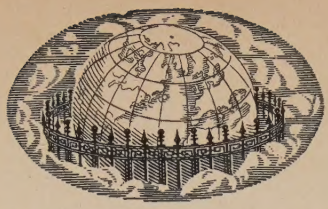

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This is a short guide to the principal contents of this volume. It is not possible to give all of the questions in The Book of Wonder, or the titles of all of the Little Verses and Problems, but in all cases the pages are given where such sections of the book begin. In the big Index, Volume 20, you will find every title and every subject, including the pictures.

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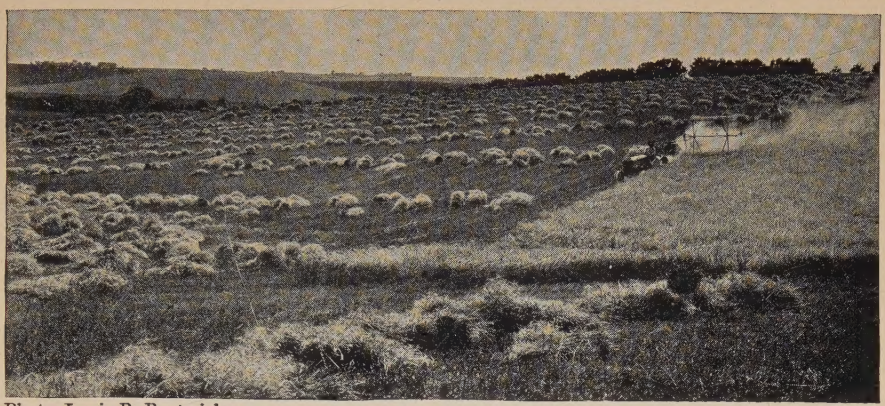


Photo, Louis R. Bostwick.

Reaping wheat in Washington County, Nebraska.

THE NORTH CENTRAL STATES

PART I

THE North Central states are: Ohio, Indiana, Illinois, Michigan, Wisconsin, Minnesota, Iowa, Missouri, North Dakota, South Dakota, Nebraska and Kansas. Although these states include only one-fourth of the area of the United States, they support nearly one-third of the population. Nine of the twenty-five largest cities of the United States are in this group. They include Chicago, the second largest city of the United States, and St. Louis, the largest city of the Mississippi Basin.

This region produces nearly one-half of all the farm crops, two-thirds of the wheat crop, two-thirds of the corn crop, three-fourths of the oat crop, and more than half of the barley crop of the United States. Many hogs and cattle are raised and fattened for the market. Apples, peaches and grapes are important fruits.

More than four-fifths of the iron-ore of the United States comes from the "ore lands" at the head of Lake Superior. Illinois ranks third among the states in the production of coal, Michigan leads in the production of salt and is third in the production of copper, while Missouri mines large quantities of lead and zinc.

The forests near the Great Lakes still yield large quantities of lumber, and the paper industry is important in Wisconsin. From the forests of southern Missouri are secured many ties, mine props, staves for barrels, and hickory handles.

These states turn out, by value, four-fifths of the farming implements, three-fourths of the automobiles, and one-third of the manufactured products of the United States. The region has two-fifths of the railroad mileage of the country. In addition, hundreds of boats carry goods on the Great Lakes and the Mississippi River system.

The people of this region have a right to be proud of what they have done. A hundred years ago the entire region had only a few hundred thousand white people and Indians. Chicago did not even exist. In 1920 nearly 35,000,000 people made their living from the forests, mines, farms and factories of the region. We shall talk about what man has done and what Nature has done to make possible this story of human progress.

The writer of this article went to a college to teach. Another member of the faculty was able to tell from his speech that the writer had been reared

in a community where people from New England had mingled with people from Kentucky and Tennessee. This community was a short distance south of Springfield, Illinois.

Between the North Central states and the Atlantic coast are the Appalachian Highlands. White people came to the interior through passes in the mountains. Some of the low places through the highlands led to the Ohio, the Cumberland and the Tennessee rivers. Many of the people settled in Kentucky and Tennessee. Then, following the streams, they came down the Ohio to Illinois and spread northward.

The farmers of New England, with poor soils and hilly, rocky land, had to work hard to make a living. They heard of the rich, smooth land beyond the Appalachian Highlands, and began to come to the West. Then they gradually moved southward from Lake Erie and Lake Michigan. Thus, the Yankees spreading southward finally reached the Southern people who were spreading northward in the central part of Illinois.

THE FOREIGNERS WHO SETTLED IN THE REGION

Not all the people now living in the section are descended from the first settlers. People from other parts of the United States have moved into this region, and before the middle of the nineteenth century foreigners began to come. Now people from almost every nation in the world live in the section. The proportion of foreign-born—about 13.5 per cent—is almost the same as in the United States as a whole.

The proportion of the native-born of foreign parents is 18 per cent, as against 14.8 per cent in the nation; while the native white of native parents is 56.6 per cent, as against 55.3 per cent in the nation. So you see the section is very close to the average in the composition of its white population. Since 1915 the number of negroes has increased considerably, but the proportion is still small.

In 1920 the number of people born in Germany was over 885,000; in Poland, over 440,000; and in Sweden, over 353,000. The number of other nationalities was smaller. Over half the Germans and Swedes, over two-thirds of the Norwegians and Dutch, and nearly three-fifths of the Danes in the United States in 1920 lived in this section.

HOW THE NORTH CENTRAL STATES WERE GRADUALLY SETTLED

When the fur-traders roamed hither and thither they used the waterways. Settlers also came by way of the lakes and rivers. A stream of settlers came down the Ohio to the Mississippi and up the Mississippi to St. Louis. From St. Louis some pioneers went up the Missouri River, while others went up the Upper Mississippi. Another stream of settlers built their log houses along the shores of the Great Lakes. There is no high land between the Mississippi Basin and the Great Lakes. Soon rivers flowing into the Great Lakes were connected by canals with rivers flowing into the tributaries of the Mississippi. A belt of settlements marked the location of these connecting rivers. Another belt of settlements followed the railroads across the level land. Gradually the belts of settlements became wider and wider, until almost all the land had been settled.

WHY SETTLERS PREFERRED THE FORESTS TO THE PRAIRIES

A large part of the regions was a prairie covered with a dense carpet of grass. In wide belts along the streams were the forests. To-day the prairie farms are generally more highly prized than the farms on land from which the trees have been removed, but the early settlers preferred farms in the forests. Why did they prefer to cut down trees when treeless prairies were near at hand?

The forest gave the pioneer the logs for his home, rails for his fences, and fuel for a fire. The soil, with no thick mat of grass, was easily plowed. The forested land was generally well drained and near a navigable stream. Drinking-water could be readily secured from springs and streams. Wild game was abundant in the forest.

The pioneer believed that land which did not support trees was poor. Then, too, much of the prairie land was poorly drained and even swampy, and it was hard work to break up the thick sod with its tangled roots. When the wonderful fertility of the soil became known the settlement of the prairies took place rapidly.

As soon as possible the early settlers planted wheat. The rich soil and the smooth surface were favorable for wheat. After it was sown no further work was necessary until harvest time. Then it

THE BEAUTY OF THE TREES

These two views of Minnesota trees, though different, are both beautiful. The silver birches on the border of the lake are often called the "ladies of the forest." The Norway pines grow straight and tall, and the road through the forest is always a pleasant way.
Photos, Kenneth M. Wright, St. Paul.

Photo, W. C. Persons, St. Louis.

Forest Park, St. Louis, is one of the largest city parks in the United States. There are beautiful lawns, attractive walks and drives, athletic fields for many sports, a zoo, the Art Museum, the Jefferson Memorial, the Open-air Theatre, and many other facilities for instruction and enjoyment.

SOME GLIMPSES OF THE GREAT CATTLE

Longview Farm, twenty miles from the heart of Kansas City, Missouri, is one of the show places of the region. The itself. Though not shown in the picture, there are dormitories and a farm hotel for employees,

In South Dakota there are still some large ranches in spite of the increase in the number of farms. These are grass-fed cattle from the range at the Mulehead Ranch near Bonesteel.

Another well-known farm near Kansas City, Missouri, is the W. L. Yost Farm at Lees Summit, Jackson County, cowmen as formerly. Their place has been taken by the Herefords, or "white faces,"

Photos of Longview Farm, courtesy Long-Bell Lumber Co.; Mulehead

ide of the picture shows some of the immense barns for cattle and horses. Longview Farm is a village in also shops of various sorts to repair tools and implements which may be broken.

Kansas City is one of the chief centres of the packing industry in the United States, and consequently the stock yards are extensive. This is only a small section of the area which is covered by the yards.

of the finest cattle to be found in the country are raised in this region. The Texas "Long-horns" are not so ney are often called. Some fine young specimens are shown in the picture.

h from Louis R. Bostwick; photo of Yost Farm from Smith & Morton.

was ground into flour for home use, and the surplus crop could be shipped to the East. Wheat has good keeping qualities and is not harmed by cold winter weather.

WHY KANSAS FARMERS PLANT WHEAT IN THE FALL

Kansas is now the leading wheat state in the section. Strange as it may seem, the wheat is planted in the fall just a few weeks before the coming of the long cold winter. The cool weather and fall rains are helpful to the plants when they are small. They send out many roots into the ground, and lie in a dormant state during the winter season. During the coldest part of the winter the plants will probably be protected by a blanket of snow. They can stand very cold weather if the change is gradual.

When the cool, moist weather of spring comes the plants grow very fast because of their large root systems. The weather should gradually grow warmer and the ground should be moistened with occasional showers. Warm, sunshiny weather should come when the seeds are ripening. These conditions are found sufficiently in Kansas to permit the production of a large crop of wheat. Wheat planted in the fall is called "winter wheat," and most of the wheat grown south of the latitude of Chicago is of this kind.

NORTH DAKOTA FARMERS PLANT WHEAT IN THE SPRING

Since little winter wheat is grown north of the latitude of Chicago, you might think that wheat is not important farther north. On the contrary, much wheat is grown in North Dakota, South Dakota and Minnesota. These states include a part of what is known as the spring-wheat region, which extends into Canada. About one-fourth of the wheat produced in the United States is spring wheat. The farmers of North Dakota, the leading spring-wheat state, plant wheat in the spring. There is a reason for this.

Cool, moist weather in the fall is less certain than farther south, and freezing weather comes earlier. The winters are cold, and a cold-wave may come when the ground is not covered with snow. If wheat is planted in the fall, there is danger that it will be winter-killed.

The North Dakota farmer plows and harrows the ground in the fall. Many insects which have burrowed into the ground for the winter are brought nearer the surface and killed by the cold winter weather. There is also no delay in planting the wheat when favorable spring weather comes.

A large part of the rain comes in the spring and early summer. The cool, moist weather of spring helps the plants to grow and to send up many shoots, which will bear seeds. During the summer, hot, dry weather becomes more frequent, and when the wheat begins to ripen in late summer, hot, dry weather is usual.

Winter wheat is planted in the southern part of the North Central states and spring wheat is planted in the northern part, because the weather conditions are not the same. Man tries to carry on his work so that Nature will help him.

WHY THE WHEAT FARMER IS NOT SURE OF A BIG CROP

The wheat farmer may try just as hard one year as another to produce a big crop, but the total amount of wheat produced varies greatly from year to year. No two growing seasons are exactly alike. The ground may be too wet or too dry to plow and harrow; the wheat may be planted too late or too early; a cold-wave may find the field without a snow cover; hot, dry weather or cool, wet weather may come at the wrong time. Hessian flies, chinch bugs, grasshoppers, rusts and smuts may reduce the yield; windstorms or hail may flatten the plants and shatter the grain; weeds may choke the wheat plants so that they cannot grow.

In the early history of our country, from ten to thirty acres of wheat was a large field. To-day, it is not unusual to find farmers with 80, 160, or even 320 acres of wheat. When wheat was first planted in this region, a "walking" plow which turned up only one furrow at a time was used. A man walking behind the plow could plow no more than an acre or two a day. Then the ground was harrowed. To-day, many horses, a steam engine or a gasoline tractor may pull a gang plow which turns up many furrows at one time. The disk, with saucer-like blades, is drawn behind the plow and breaks up the clods into fine pieces. One man can plow and harrow twenty or more acres in a day.

Formerly, the cradle, an improvement of the scythe, was used to cut the wheat, and one man could cut four acres or less in a day. Now, a binder pulled by horses or a tractor cuts a wide path across the

"THE FARMER FEEDETH ALL"

Alfalfa, a valuable forage plant, belongs to the Clover Family, and is a native of Western Asia, but has long been known in Europe. The tap-root sometimes goes down fifteen feet in search of moisture, and therefore it will grow where the rainfall is scanty. This is a field of Grimm alfalfa in North Dakota.

The attractive picture on the left shows an Iowa farm "where the corn grows tall." Generally this state leads in the production of this important cereal. North Dakota leads all the other states in the production of hard spring wheat from which excellent flour and bread are made.

Photo of corn from Louis R. Bostwick; others, courtesy Commissioner of Immigration, North Dakota.

field and ties the cut grain into bundles. The bundles, or sheaves, are dropped upon the ground four or five in a place. Men called shockers follow behind the binder and place the sheaves together so that they will continue to dry out. Thirty or more acres of wheat may be cut in a day by one man on a binder.

Man has learned how to make and use farm implements, but gang plows and binders would be of little value in a rough or rocky region. These states have a large area with a smooth surface and a fertile soil. Nature has made it possible for man to use plows, reapers and binders

The settlers soon found that wheat was their best-paying crop, and took some of it to the head of navigation, a short distance below the falls, and sent it down the river. At the head of navigation St. Paul was founded. Much of the wheat, with the help of cheap water power, was made into flour at Minneapolis, and sent eastward to the consumer. Flour from spring wheat at first was not so highly valued as flour from winter wheat, but in 1878 the first complete roller flour mill in the United States was completed at Minneapolis. By this new method it was possible to make better flour from spring

Photo, courtesy Civic and Commerce Association.

In its upper course the Mississippi is crossed by many bridges. This is the graceful Third Avenue Bridge in Minneapolis, one of the most prosperous and attractive cities of the North Central States.

doing many times the work of the walking plow and the cradle of earlier days.

The twin cities, Minneapolis and St. Paul, are so called because they adjoin. These cities are not in the centre of the spring-wheat region, but on the eastern margin; yet from the beginning their prosperity has been closely related to the spring-wheat region for this reason.

When settlers entered the grasslands to the west of the Mississippi River it was necessary to bring in lumber. Tributaries of the Upper Mississippi extended into a heavily forested area and logs were floated downstream to the Falls of St. Anthony, where water power was used to saw the logs into boards. Minneapolis is on the Mississippi River at the Falls of St. Anthony. The settlers to the west came to depend on Minneapolis for their lumber and farm tools.

wheat than from winter wheat. Minneapolis has become the greatest flour-milling centre of the world. The twin cities lie between the spring-wheat region and the manufacturing cities of the East. They not only receive the products of the region, but also distribute manufactured goods.

Every state produces some corn, but the heart of the Corn Belt extends from eastern Nebraska to eastern Ohio. It includes Nebraska, Iowa, Missouri, Illinois, Indiana and Ohio. These six states produce about half of the corn crop of the United States. With parts of some of the adjoining states this area is called the "Corn Belt."

Except the easternmost part, the prairies include most of the Corn Belt. This region is almost level, or but slightly rolling, and modern farming implements can

THE RED MAN YESTERDAY AND TO-DAY

On the left, Indian mounds in St. Paul. The Falls of Minnehaha, made famous by Longfellow in Hiawatha, are in a Minneapolis park. At present they are almost dry, but efforts to restore them are under way. The inset is Lorado Taft's statue of the Indian chief Black Hawk at Oregon, Illinois.

A present-day Indian and his squaw are gathering wild rice in a lake. A few moose still survive in northern Minnesota, and white-tailed deer are rather plentiful in some sections.

Photos of mounds and wild rice by Kenneth M. Wright, president, Izaak Walton League of America; Minnehaha, courtesy Minneapolis Civic and Commerce Association; deer, courtesy James F. Gould, Commissioner of Fish and Game; Black Hawk Statue, courtesy National Photo Company.

be used. Much of the soil is a rich loam that was left by a great sheet of ice that covered nearly the whole area of the North Central states many thousands of years ago.

Some of the land the early settlers found was poorly drained, but surface ditches were dug, and thousands of feet of tile were placed underground. The glacier left a top soil of ground-up rocks rich in plant food. Through the decay of prairie grasses much humus, giving the soil a dark color, was added to the soil. Corn grows best in the loamy type of soil thus formed.

Corn requires about five or six months of growing weather. The nights as well as the days should be warm, and there should be frequent rains followed by sunshiny weather. Cool, frosty days in autumn help the ears of corn to cure properly. These weather conditions are found in the Corn Belt. In fact, it is the largest continuous area of suitable cornland to be found anywhere on earth, but weather conditions are not always ideal, and many insect pests and diseases reduce the yield.

WHY CORN BECOMES LESS IMPORTANT ELSEWHERE

To the north the growing season is shorter, and corn will not always ripen, although corn is grown. Much of the land is given over to pastures and hayfields. Large dairy barns dot the landscape. The Corn Belt to the north gradually merges with the dairying belt, which stretches from Minnesota eastward to the Atlantic coast. Many large cities near at hand need fresh milk, while butter and cheese can be shipped long distances.

But what does green corn have to do with dairying? While the corn is still good for roasting ears, or in the milk stage, the stalk, leaves and ears are chopped up together and packed in a silo. This food is good for the cattle during the winter season, when there are no green pastures. Some of the soft corn is sent to canning factories.

To the south of the Corn Belt much corn is grown, but the growing period is long, and the strength of the plant goes to stalk and leaves. The yield is generally less than in the Corn Belt. The corn contains more water and will not keep so well in the warm, moist climate. Insect pests and diseases are more numerous than in the Corn Belt. Moreover, cotton competes with corn for the best soil.

To the east of the Corn Belt the rugged Appalachian Highlands produce corn, but a large part of the area is not suitable for farming. To the west the altitude gradually increases to nearly a mile above sea-level on the Great Plains of western Nebraska and Kansas. The growing season is short, the rainfall is uncertain, and hot days may be followed by cool nights.

HOW THE HUGE CORN CROP IS USED

Although the United States usually produces less than a billion bushels of wheat, there is generally a large amount for export. Since the United States produces over two and one-half billion bushels of corn annually, which is about three-fourths of the total amount for the world, it might be thought that much of the corn crop is exported. But only 2 or 3 per cent of the crop is exported. Moreover, only about 10 per cent of the crop is directly used as human food. Yet the corn crop is the most valuable crop raised by the American farmers.

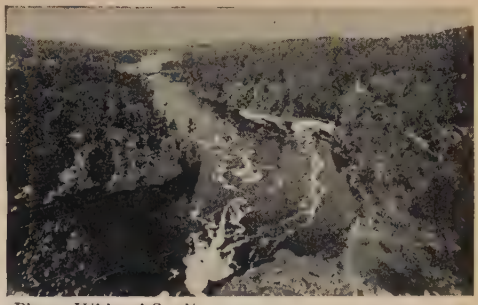
The larger part of the crop is consumed on the farm where it is produced. While corn is not so valuable as wheat per bushel, it is about as expensive to ship, and so the farmer finds it profitable to feed his corn to live stock. He can convert four pounds of corn into a pound of pork, or six pounds of corn into a pound of beef. About 40 per cent of the corn crop is fed to hogs, while another 15 per cent is fed to cattle. About one-half the hogs, over one-fourth of the cattle, and one-third of the poultry of the United States are in the six Corn Belt states. When we think of the pork, beef, mutton, poultry, lard, eggs and dairy products that we consume, do we wonder that a writer has said that "corn is the principal source of food of the American people"?

WHY MIXED FARMING IS BECOMING MORE COMMON

The prairie soils were so fertile that the same field was frequently planted to corn for many years, but finally the farmer got smaller yields, and found that he must try to keep his soil fertile. The legumes, such as alfalfa and clover, help to build up the soil. The pastures can be grazed, hay can be made for the stock, and the green grass can be plowed under to add humus to the soil. A rotation of crops also improves the soil. So the corn farmer rotates his crops. In the northern part of the Corn Belt corn is rotated with

BY THE RUSHING OF MANY WATERS

Photo, Kenneth M. Wright.
Bottom lands along the Upper Mississippi River.



Photo, Hibbard Studio.
St. Croix River between Minnesota and Wisconsin.

Photo, Bennett.
Among the Dells of the Wisconsin River.

Typical fish house on a stream emptying into Lake Superior.

Sunset on St. Marys River near the "Soo" Canal.

The strange Pictured Rocks on Lake Superior.

Rainbow Bend, near Marietta, Ohio, looking up the valley of the Muskingum River. This is a very fine agricultural region and was one of the first parts of Ohio to be settled under the Ordinance of 1787.

oats, clover and timothy, but in the southern part, with wheat, clover and timothy. In the western part, where rainfall decreases, alfalfa takes the place of clover and timothy. Hogs, cattle and sheep are fed in large numbers, and the soil is enriched through the addition of animal manures.

Spring-wheat farmers have found it more difficult to rotate their crops, which must be adapted to a short growing season during which some of the nights may be cool, and a long, cold winter season. The spring-wheat states produce a large part of the rye, barley and linseed crop, but these crops do not improve the soil much for the cultivation of wheat. Potatoes yield well and are produced in large quantities, but unlike wheat, they are ruined if the temperatures are low. The winter comes so suddenly that thousands of bushels may be frozen. The price offered for the potatoes may be so low that it does not pay to dig them. If the United States should turn to alcohol as a source of fuel, potatoes, from which alcohol can be made, can be raised here in almost unlimited quantities. While the long, cold winters are a handicap, it is probable that dairying will become more important in the spring-wheat states.

WHY MICHIGAN PRODUCES SO MUCH FRUIT

Although Michigan has a high latitude, it is the most important state of the group in the production of fruit. A glance at a map will show you that the lower peninsula of Michigan is bounded by Lakes Michigan, Huron and Erie. The temperature of these great bodies of water changes very slowly. In the spring, cool winds from the lakes blow over the land. The cool air holds back the buds on the trees until the danger of frost is past. In the fall, the lakes do not cool as rapidly as the land. Lake breezes then give the land a higher temperature than it would otherwise have. The influence of these bodies of water decreases inland.

The eastern shore of Lake Michigan has a famous peach belt, but there is little fruit on the western shore. The wind blows generally from the west. Those which reach the eastern shore have passed over the lake, while the winds which reach the western shore have passed over hot land in summer and cold land in fall and winter. Apples, pears and grapes are hardier fruits than peaches and can be grown farther away from the lakes. Missouri, in a lower latitude than Michigan, is developing its peach and apple orchards and strawberry patches very rapidly. It is possible that Missouri, "the land of the big red apple," will finally surpass Michigan in the production of fruit.

HOW THE FARMER IN THIS REGION LIVES

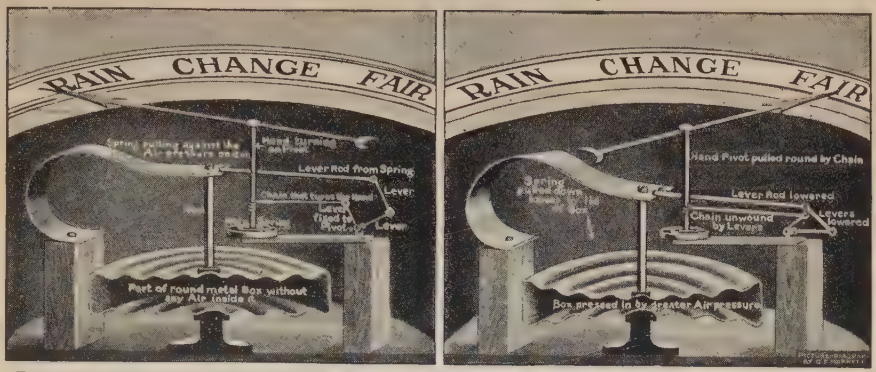
The early settlers had many hardships, They had to build their log houses and clear the ground; they made their own homespun clothing. Rarely could they secure the help of a physician. They were all but cut off from the outside world, and had to depend on themselves. The stranger was eagerly welcomed and was asked for news of the outside world.

To-day the farmers live much more comfortably. Mr. Jones lives on a 160-acre farm near Bloomington, Illinois, in the Corn Belt. He has about ten acres which include the house, a tenant house, a corn crib, a horse barn, a dairy barn, a poultry house, a machine shed, a tool shed, a garage, a water tower, a hog pen and a garden. There is a front yard shaded by maple and elm trees. The rest of the farm is divided into fields by means of fences. The hedges of earlier days have been replaced by wire fences. The whole farm presents a much neater appearance than formerly.

Mr. Jones raises corn, wheat and oats, but a large part of the farm is in pasture, and there is a ten-acre patch of alfalfa. He finds it necessary to keep many hogs and cattle to help maintain the fertility of the soil. He rotates his crops, the usual order being corn, wheat or oats, clover and timothy.

A windmill and a gasoline engine are used to pump water to the water tower. Water flows from this tower through pipes to the house and to the tanks where the animals are watered. This farm has electric light, a telephone and a radio set. The postman brings the mail every day. A good oiled road leads to the near-by village, which is on a railroad line. The work of the farmer and his hired hand is carried on with modern farming implements. The farmer's wife has hardwood floors, running water, a piano, an electric washing machine and an electric iron. Similar farms extend for miles in all directions. The farmers of this community do not just merely exist: they live.

THE NEXT STORY OF THE UNITED STATES IS ON PAGE 5447.


RAIN CHANGE FAIR
Lever Rod from Spring
Lever
Lever fixed to Pivot
Lever
Part of round metal Box without any Air inside it
RAIN CHANGE FAIR
Hand Pivot pulled round by Chain
Lever Rod lowered
Chain unwound by Levers
Levers lowered
Box pressed in by greater Air pressure

The most familiar barometer is the aneroid barometer. The first picture shows its various parts, and the second shows how these work. The air presses down with greater or less force on the metal box, from which all the air has been exhausted, and this moves the hand, or indicator.

THE PRESSURE OF THE AIR

WE speak of matter as being solid or liquid or gaseous; but two of these states are more like each other than they are like the third. Water is different from the air above it; but there is one important respect in which water and air are far more like each other than either is like the solid ground, and that is that they will both run or flow.

In the solid ground there are forces holding together the molecules, so that the shape of the whole is maintained; but the shape of the air or water—if we can speak of such a thing—changes from moment to moment if it is allowed to, because both air and water flow. So liquids and gases are known as fluids in the language of science.

Now, in any fluid, at any time, and at any place, there is a pressure which is called fluid pressure, and there is at least one instance of fluid pressure which we have all measured, though perhaps we did not know we were doing so. That is the pressure of the air. This atmospheric pressure is by far the most important kind of fluid pressure in our lives.

We know that we really live at the bottom of a great ocean of air. On the floor of this ocean we live and crawl about, and if we can swim in it for a little while at a small height—as we do in flying machines—we are very proud of ourselves. Everywhere in this immense ocean there is fluid pressure. Perhaps the first and most important consequence of this fluid pressure is that it enables us to breathe. What happens when we breathe is that we make a movement which tends to empty the space in our lungs of everything; but as that space is in communication with the outer air, the atmospheric pressure drives some of the outer air into the space we make. Thus, without the atmospheric pressure we could not breathe.

Now, it is only three hundred years ago since, in studying a case like this, men said that the reason why air or anything else would rush into an empty space, if it could, was that Nature objected to anything's being empty. The phrase which they used, and which they accepted as an explanation, was "Nature abhors a vacuum." *Vacuum* is the Latin for "empty." But about three centuries ago it was discovered *why* Nature abhors a vacuum, and also to what extent Nature abhors a vacuum. It was found that what really happens is always the consequence of fluid pressure. We owe this discovery to an

Italian named Torricelli, the most famous of Galileo's pupils.

We all know that it is possible by means of a pump to pull up water, and it was found that there was a certain height to which water would rise in a pump—about thirty feet. But in no ordinary pump will water rise, say, fifty feet. Thus it was observed that there was a limit to Nature's dislike of a vacuum. Torricelli thought that other fluids would behave as water does. He thought also that the water rises in a pump because of the pressure of the atmosphere, and that if he took a much heavier fluid than water it also would rise, but, being heavier, would rise less. He took the heaviest of all fluids, mercury, and proved that the mercury does rise in the same way as water does, but to a much lower height.

The pressure of air that will balance a column of metal

It is easy to understand the famous experiment of Torricelli which proved for the first time the existence of atmospheric pressure and explained why it is that Nature abhors a vacuum. If we fill a glass tube (closed at one end) with mercury, and turn it upside down in a cup that already contains mercury, what will happen to the mercury inside the tube? We might expect that all the mercury would run out of the tube into the cup, but it does not. Something holds up the column of mercury in the tube. The earth, we know, is pulling by gravitation on the mercury; what is the opposing force that holds it up? The answer is that it is the atmosphere pressing down on the surface of the mercury in the cup and pressing some of it up into the tube.

Now, if the tube is short, the mercury will fill it; but if we use a tube three feet long, and having filled it with mercury, turn it upside down in a cup of mercury, the whole of the mercury will not be held up. On the average, the mercury will drop about six inches. In other words, the pressure of the atmosphere is about equal to supporting a column of mercury thirty inches high.

It is interesting to ask what fills the space in the tube above the level of the mercury when the mercury drops. There cannot be any air there; and we might suppose that there must be nothing there —that it must really be a genuine vacuum. In fact, it is as nearly a complete vacuum as we can obtain, and it is known as a Torricellian vacuum. It is not perfectly empty, for liquid mercury may turn itself into a gas, or vapor, and so, though there is no air in a Torricellian vacuum, it contains a certain amount of the vapor of mercury. It is in some degree possible to prevent the mercury from evaporating much; and so we can get in such a tube the nearest approach to empty space that is possible for us.

How we can measure the pressure of the atmosphere

It is possible to measure the length of a column of mercury in one of these tubes, and so, if atmospheric pressure were greater or less one day than the next, we ought to notice that the column of mercury in the tube is of a different length on the two days. If atmospheric pressure is high, strong, and pressing down more firmly on the surface of the mercury in the vessel, it ought to be able to hold up a longer column of mercury; and if the atmospheric pressure is low, it will not hold up such a long column of mercury.

When we think of a man pressing down with his fist on a table, or of the game people sometimes play at fairs when a man strikes with a hammer on a knob, making a weight run up a pole, we realize what happens in the column of mercury. This experiment of Torricelli's not only proves the existence of atmospheric pressure, but also enables us to measure it.

But, apart from such changes as may occur owing to something's happening in the atmosphere, we ought to be able to show that if we rise high up in the atmosphere the mercury in the tube falls, because the higher we rise, the less is the weight of air above us, and the less must be the atmospheric pressure. In the same way the pressure of water increases as we go down in the sea, as every diver knows.

What happened to a tube of mercury on a mountain

A still more famous man than Torricelli, the great French thinker Pascal, made this experiment soon after Torricelli's work was begun. Acting on his instructions, his brother-in-law carried one of Torricelli's tubes up the Puy de Dôme, and found, as Pascal anticipated, that the mercury in the tube fell as he ascended the mountain and rose as he descended, because the weight of the atmosphere overhead diminished as he went up and increased as he came down.

The variation of the atmospheric pressure at different heights has many interesting results. For instance, when men go up in the air they feel the consequences of the steady lessening of the pressure on which breathing depends, and they may suffer severely; there is a thing called mountain sickness, which depends on this lessening of atmospheric pressure. A good many people sleep badly at low pressures of the atmosphere—that is to say, when they go among mountains—and do better at sea, where, of course, the pressure of the atmosphere is as high as it can be.

When people have lived for a few days at some great height the body produces a greatly increased number of red blood cells — those which carry oxygen from the lungs to the various tissues. On a mountain-top the air is so rare, as we say (or the atmospheric pressure so low), that the body must make arrangements accordingly, and so it produces these new cells.

MEASURING A MOUNTAIN WITH AIR

The height of a mountain can be measured with a barometer. In the left-hand picture we see a barometer on a mountain two miles high. The pressure of the atmosphere on the cistern X causes the mercury to rise to a certain height in the tube V. Down in the valley the greater weight of the air on the cistern makes the mercury rise higher in the tube, and by comparing the two readings of the barometer the height of the mountain is discovered.

In a Torricelli tube for measuring the pressure of the atmosphere we have what we may call a barometer, which really means "weight-measurer." Every time we look at the barometer we are measuring the pressure of the atmosphere, for that is all the barometer does.

The pointer is so made as to indicate the height in inches of the column of mercury which the atmosphere is holding up, then and there.

The relation of the barometer to the weather lies in the fact that, on the whole, the most important thing in deciding the weather is the atmospheric pressure. If the atmospheric pressure is very high, there will be no disturbance; if it is very low, the air will be rushing in from places where the pressure is higher. That means wind, and wind in turn may mean rain.

So we see where the connection between the barometer and the weather comes in; and when we find that the barometer cannot quite be trusted as a weather-glass we must remember that the causes of weather are complicated, and that atmospheric pressure is only one of them.

The barometer also gives us a way of discovering how high a mountain is. All we have to do is to find out how much the mercury falls for every thousand feet we go up, and then we can reckon how high a mountain is. There is, however, one serious condition attached to this method, which is—first climb your mountain! That is often impossible; and in any case there are more accurate ways of measuring heights than by observing a barometer.

The ordinary barometer that we see everywhere is really Torricelli's instrument; but the end of the tube is usually

turned up so as to make it U-shaped, instead of having the tube straight and the end of it in a vessel of mercury.

A BAROMETER MADE WITHOUT USING MERCURY

There is another kind of barometer which has no mercury or any other liquid in it, and which is called an aneroid barometer—literally, the barometer that has no fluid in it. It is simply a round, flat, metal box which has been emptied of air as far as possible. The top and the bottom of the box are pressed toward each other by the atmosphere, and it is not difficult to make arrangements by which we can easily read off the extent to which the box is being pressed.

If we took an ordinary mercury barometer and made it warm, the mercury would expand and take up more space in the tube, as most things do when they are warmed. Therefore, if we want our results to be precise, we should always be able to allow for the temperature when using a barometer. So a good barometer always has a thermometer, or "heat-measurer," with it. In making a barometer we should first boil the mercury so as to get out of it all the air and water-vapor that we can. If we omit to do this, the air and water-vapor will pass out of the mercury into the vacuum at the top of the tube and will prevent the mercury from rising as high as it should rise.

THE AIR PRESSURE ON OUR BODIES IS EQUAL FROM ALL DIRECTIONS

If we take our reckoning at mean sea-level we find that the pressure of the atmosphere is equal to the pressure of a little more than fourteen pounds on every square inch of surface. Our own bodies are, of course, exposed to this great pressure on every square inch of their surface; if the pressure were wholly a downward one we could not stand it. But a great law about fluid pressure is that at any place it is the same in all directions. Therefore, though we are pressed down upon, we are also pressed in upon from the side, and thus we are equally supported from all directions, and the atmospheric pressure does us no harm. If it should happen that at any part of our bodies we were not equally pressed upon, we should soon notice a startling result.

If we take a little glass tube and burn something in it so that it becomes filled with hot air, and then quickly press the mouth of it against the skin, it is interesting to see what follows. The air inside the tube is very hot, and air, like most things, expands when it is hot. But in a little while the air becomes cooled, and as it cools it shrinks. This means that the pressure inside the tube is lower than outside it. Another way of putting this is that the pressure on the piece of skin covered by the tube is less than the atmospheric pressure on the rest of the body.

The laws of force are bound to have their way; the pressure on the skin outside the tube squeezes some of the fluids of the body up into the tube, and the skin inside the tube—which is not being pressed upon as the rest of the skin is—is forced up into the tube by the pressure of the fluid underneath it, sometimes quite a long distance.

If a medical student has nothing better to do, and puts three or four such tubes on his forehead and walks about with them sticking there, he looks absurd, but he teaches those who see him that the pressure of the atmosphere on the surface of our bodies is something very real.

A BOY'S GAME THAT PROVES A SCIENTIFIC LAW

The game boys play with a sucker and a stone also depends on atmospheric pressure. We know that a piece of soft leather, when moistened, will hold a stone and lift it up; but the instant the corner of the leather is raised, and the air is allowed to rush in, the stone will drop.

We have seen that it is atmospheric pressure by which we breathe. Sometimes, however, instead of wishing to draw air into our lungs, we wish to draw water into our mouths. Take the case of drinking lemonade through a straw, or of filling an ink-dropper with ink for a fountain-pen. It is atmospheric pressure that we use in these cases. When we suck through the straw all we do is to lower the pressure at the end of the straw in our mouths, and then the pressure on the surface of the fluid in the tumbler pushes some of it up the straw. If we keep the tip of our tongue over the end of the straw, we can hold the column of fluid in the straw in spite of the attraction of gravity. But when we take our tongue away, and allow the pressure at both ends of the straw to be equal, gravity has no force to oppose it, and the column of fluid falls.

Such use of a straw is just the same as

the way in which an ink-dropper is filled; and an ordinary pump is just the same. Inside the pump is a thing called a piston which fits it closely, and when the piston is raised, it lowers the pressure inside the pump and liquid is sucked up—that is to say, it is pushed into the pump-cylinder from outside by atmospheric pressure. We are speaking now of the ordinary vacuum pump. What is known as a force-pump can raise water much higher than a vacuum pump, but it works upon an entirely different principle.

Atmospheric pressure is the most important, and perhaps the easiest to understand, of all kinds of fluid pressure. When we go more closely into the laws of fluids we find them exceedingly difficult, yet one or two results are easy to understand.

THE MAN WHO FOUND THE LAW OF EQUAL PRESSURE

The law that the pressure of a fluid at any point is equal in all directions has already been mentioned, but if we are to state this law quite correctly we must add one word. We must say not "a fluid," but "a motionless fluid." Of course, as soon as we introduce a new condition, the motion of the fluid, for example, then the whole case is changed. For instance, we do not feel the atmospheric pressure to any noticeable extent, but we *do* feel the wind.

This law of the equality of fluid pressure in all directions stands to the credit of that extraordinary Frenchman Pascal. He is to be called extraordinary because his mind was so complete. People who study religion and duty and good and evil read the works of Pascal because he thought so deeply on those subjects; people who study pure mathematics have to make acquaintance with Pascal; and people who study what happens in a tumbler of water have to study Pascal, too.

HOW WE CAN PROVE THE TRUTH OF PASCAL'S LAW

Now, it is interesting to invent an experiment to prove the truth of Pascal's law. If we take an empty bottle and cork it, and push it down into deep water, or sink it by attaching a weight to it, the fluid pressure will force the cork into the bottle. It does not matter whether the bottle is right side up or upside down or at any angle—the result is the same. Therefore, to take the example of a fish swimming in the water—it is subjected to a pressure upward as well as downward and sidewise. The point is that the fluid has no greater tendency to press in one direction more than in another.

Here we find the great difference between fluid pressure and the pressure of this book on the table, or the table on the floor, or the beams of the roof against the walls of the house. Pressure exerted by one solid thing on another is in one direction only.

GASES THAT CAN BE COMPRESSED AND LIQUIDS THAT CANNOT

The great laws of fluid pressure are the same for both kinds of fluids; but it is plain to everyone that, however true this may be, there must be some great difference between the kind of fluid we call a gas and the kind we call a liquid. If we take any gas, or any mixture of gases, and squeeze it, we find that it can be squeezed. When we cease to apply force it expands again. The proper way of saying this is that a gas is compressible; but the other kind of fluid which we call a liquid is practically incompressible.

It is possible, with very great pressure indeed, to compress water a little, and we should understand this; but still there remains the great difference that a gas is readily compressible and that a liquid is not. Now, as gases can be compressed by pressure, we should know whether there is any law governing the results. There is such a law, and it is very important for us to know. It explains some of the things that we may see almost any day, though perhaps we have not stopped to ask the reason why certain consequences follow certain causes.

THE DISCOVERY OF ROBERT BOYLE WHICH EXPLAINS A GAS EXPLOSION

It was discovered by, and is named after, a celebrated Englishman named Robert Boyle, who lived in the seventeenth century. Boyle's law says that if the temperature of a gas remains the same, the less space it fills, the greater its pressure. If this pressure is to rise, the volume must fall; and if the pressure is to fall, the volume must rise. This means that a certain proportion of gas will exert more pressure as it occupies a smaller space. We realize this when we hear a great explosion as the result of suddenly making a lot of gas in a very little space.

THE NEXT STORY OF THE EARTH IS ON PAGE 5423.

MID GREENLAND'S ICY MOUNTAINS

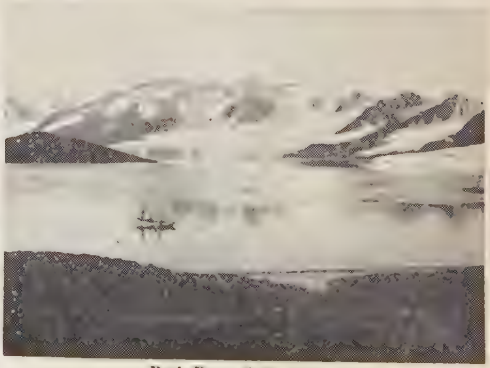
Natives of Greenland.

A milkmaid of Iceland.

Two girls of Greenland.

A group of little Greenlanders.

Godthaab, a town in Greenland.



Red Bay, Spitsbergen.

Photos, Norwegian State Railways, Swedish Tourist Agency, Ewing Galloway, McLeish, Mansell, Bolok.

The harbor of Stockholm, the capital of Sweden.

SCANDINAVIA

SCANDINAVIA, the largest peninsula in Europe, contains Norway and Sweden, but the Scandinavian race also occupies Denmark and the island of Iceland on the edge of the Arctic Circle; and though the Scandinavian peoples are now ruled as three kingdoms, their histories are so interwoven that it is better to look first at the race in history, and then at the separate countries as they exist to-day.

The people of northern Europe—the Teutonic races, as they were called before the World War—are now called the Nordic branch of the human family. In Germany, the Netherlands and Great Britain that stock is mixed to a considerable extent with other races, though in the main their people are Nordic, but the Swedes, Norwegians and Danes, with comparatively few exceptions, are pure examples of the Nordic race.

Their languages, though now getting farther away from one another, are the same in origin. Their religion, before Christianity reached them, was much the same throughout the various tribes. Their mythology and early poetical history is common to all. Their character and ways of living were alike, whether they had their homes on the Danish and Norwegian shores of the North Sea, the Scandinavian fiords of the North Atlantic or the lower coasts of the Baltic. All of them believed when they saw the bright rainbow in the sky that it was the bridge by which the gods rode to their home, Asgard; and when they heard the roar of the thunder, to all it was Thor the Strongest rattling past in his cart or banging his great hammer. Like the Angles and Saxons, they, too, believed that the great All-Father Odin, or Woden, received all slain in battle to feast forever in his great hall, Valhalla.

For war was their principal occupation, and the chiefs went on fighting each other for desirable tracts of land that gradually grew into small kingdoms. At last a sudden activity stirred in the hearts of the dwellers of the fiords and some of their neighbors.

Like a destructive tempest these wild raiders swept round northern and western Scotland to northern Ireland, to the Isle of Man and the coasts of Cumberland; they divided northern England on its eastern side, from Northumberland to the Wash, with their Saxon cousins, who had come there, like themselves, as adventurous invaders centuries before and had settled in the land. They seized the part of France now called Normandy, and made their way up the Seine till they threatened Paris. They penetrated far into the Medi-

terranean. They crossed from the Baltic to Constantinople by way of Russia, and founded kingdoms as they passed along. The first king in the dim beginnings of Russian history was Rurik, a Northman from Sweden, who was crossing Russia toward the East when the Russians asked him to stay with them. "From the rage of the Northmen, deliver us, O Lord," was the prayer that rose up from far and near, as churches and farms were burned, and people were killed or enslaved, while their worldly goods were carried off to the high-prowed ships of the Vikings.

The Northmen made their homes permanently in Iceland, and from there sailed away to the north and west and discovered Greenland. From Greenland they reached America nearly five hundred years before Columbus rediscovered it when seeking India.

These men who, a thousand years ago, were the world's first discoverers led into adventure by the belief that the only honorable ending to life was a violent death, were the ancestors of the Scandinavian race, which from its Norwegian branch sends more people to sea, and owns more ships in proportion to its population than any race in the world.

THE WARLIKE PAST OF A PEACEFUL PEOPLE OF TO-DAY

But it would be difficult to imagine a people more unlike the fierce Viking raiders of a thousand years ago than the Swedes, Danes and Norwegians of to-day. That the qualities of daring and steadfastness remain deeply and firmly in their natures has been proved through all the centuries since they gave up their pirate rovings. They have a terrible record of wars, though they have had only one war in the last hundred years. Few in numbers and never rich, they have waged with desperate bravery, and only partial success, wars far beyond their strength. Now they live only in their own native lands with all their conquests lost. But they have given stronger nations the impression that it is best to leave them alone. The energy of the breed shows itself not in violence, but in a quiet mastery of the modern means for life that wins respect on all sides. The Dane, the Swede and the Norwegian, in education, courtesy and the practical use of the resources within their lands, are in the front rank of civilization. We must glance at the history that has brought the race from their days of pillage and conquest to the present peaceful prosperity.

THE QUEEN WHO MADE ONE NATION OF DENMARK, SWEDEN AND NORWAY

Very little was known of the Scandinavian race by the Romans. Mediterranean civilization was cut off from the north by the Nordic tribes of Germany, and Christianity did not reach either Denmark or Sweden till about A.D. 1000.

In the meantime, in the big and little peninsulas, and on the islands between them, the three kingdoms were gradually settling down. For about four centuries, from the tenth to the fourteenth, they kept fairly distinct and independent of each other, though for a time the kings of Denmark, Sweyn and his son, Canute the Mighty, were practically emperors of the North, ruling not only over Denmark, Norway and part of Sweden, but, as we read on page 1436 over England across the sea.

Sweyn's father had adopted Christianity for Denmark. In Norway, about the same time, there were two kings named Olaf, whose doughty deeds forced Christianity on their unwilling people. The second Olaf, with the flaming red beard, is St. Olaf, the great hero of Norway, for his adventurous life, and still more his tragic death, took firm and lasting hold of the imagination of his fierce countrymen.

OLAF, THE HERO-KING OF NORWAY, WHO FACED THE ANGRY PEASANTS

After helping Ethelred of England against the Danes he bided his time till he could establish his claims to his father's throne. Facing his angry people, who objected to his reforms, he struck down their idol with his club, and after many battle-cries of "Forward, Christ's men, Crusaders, the king's men!" and "Forward, forward, peasant men!" Olaf fought his last desperate fight, on August 31, 1030. The date is fixed because as the king died there was a total eclipse of the sun, terrible to the peasants, who thought it a sign of God's anger. St. Olaf was buried at Nidaros, at the mouth of the Nid, on the Trondhjem Fiord.

It was in the days of the Olafs that Leif the Lucky sailed away to the West, and was the first European to discover Greenland and part of the shores of North America.

Another name stands out in these early

HERO-KINGS WHO MADE SWEDEN GREAT

Gustavus Vasa, the deliverer of Sweden, was crowned king in 1523, and under him Sweden became a Protestant nation. He was a good king, hated drunkenness and gluttony, and did much to elevate his people. In this picture, by the famous Swedish artist Saloman, we see him engaged in his crusade for pure living. He has come suddenly upon a drinking party of his subjects, and has with his sword destroyed a barrel of liquor. He overcame many difficulties: restored authority and raised the revenue.

Gustavus Adolphus, king of Sweden, knew eight languages, was a clever statesman and a brilliant general. When he championed the Protestants of Germany he made the emperor's forces fear the "Snow king and his bodyguard," as he and his small army were called. He was everywhere victorious, but at Lutzen, in 1632, although the Swedes won, their king was slain. Here we see him praying for victory before the battle, which, as afternoon drew on, was fought in the gloom of a thick autumnal mist.

days—that of Sverre, who led the Birchlegs, so called from the bark they bound round their legs, against the Baglers, who represented the Church and nobles, in wild contest for the kingdom. The bravery of Sverre and his Birchlegs was splendid; the old historians tell us how Sverre put down the nobles who oppressed the people, and how he maintained law and order, after long and fierce fighting by sea and land.

THE CAPTIVE CHIEF WHO TOLD A DYING KING THE WONDERS OF THE EAST

The Bagler chief with whom he last fought had been on a crusade to Constantinople and Jerusalem, and when the two, both ill, were lying side by side on the ship's deck that was taking them to Bergen, as they gazed at the clouds fleeting across the wintry sky, the conquered Bagler told his conqueror, Sverre, about his wonderful adventures in the East, and of the glories of Constantinople. Sverre died on land. He was one of the greatest kings that ever ruled over Norway.

Two centuries after his death, all three kingdoms were united for about 125 years under the rule of Denmark.

The union, though marked by Swedish rebellions, continued till 1523, when Gustavus I, who was elected king, resenting harsh government by the Danes, began a separate career for Sweden which made her mistress of the Baltic.

Gustavus was a Protestant, and he and his grandson Gustavus Adolphus became champions of the reformed faith. The aim of the Swedes was to shut out Russia from the Baltic Sea and to be masters of northern Germany. Up to the middle of the seventeenth century they succeeded so well that Sweden was mistress of that part of the world, and unquestionably one of the great powers of Europe. But she was attempting more than her strength, either in men or in means, could possibly sustain, and the wildly pursued wars of Charles XII, a brave soldier without any idea of diplomacy or statesmanship, brought his country to ruin and loss.

Denmark, too, in the seventeenth century engaged in ambitious wars, partly because her kings were jealous of the Swedish kings' championship of Protestantism. In the end she was obliged to give up to Sweden the provinces on the eastern side of the Sound which she had long held, and which included Scania, that gave the whole peninsula its name.

THE LITTLE NATION THAT TREATED A BIG NEIGHBOR LIKE A POOR RELATION

Into all her wars Denmark carried her companion state Norway, whom she treated very much like a poor relation, though Norway was enriching the national life, particularly in literature. When the Napoleonic wars broke out, Denmark joined with Napoleon when his plans were specially directed against England and her commerce. The result was that in both 1801 and 1807 the British were compelled in self-defense to take Copenhagen and the Danish fleet.

The action of Denmark in supporting France led to her loss of Norway. One of Napoleon's marshals, Bernadotte, had been chosen by the Swedes to be their king, and he, feeling sure that Napoleon would lose his fight against the rest of Europe, offered to bring the Swedish army into the war against Napoleon if the Allies would promise to take Norway from Denmark and give it to Sweden. The bargain was struck and carried out. Bernadotte helped to overthrow Napoleon at Leipzig, and received Norway as his reward, without the Norwegians' being asked whether they wished to remain under the Danish crown or be transferred to Sweden. So, for ninety-one uneasy years, from 1814 to 1905, Norway and Sweden were under the same king, though separated by sentiment and rival interests.

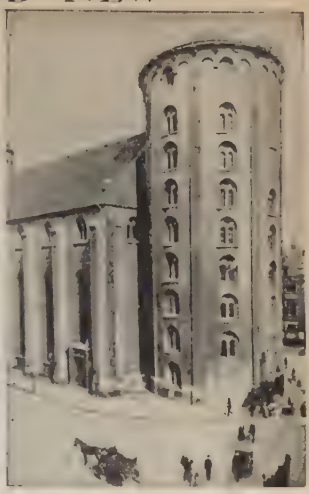
The final difference between the two countries was that Norway demanded that she have her separate ministers at foreign courts. To this Sweden would not agree, and the two countries seemed to be on the verge of war when Sweden gave up her objection to Norway's withdrawing from union with her, choosing rather to have a friendly neighbor than a resentful member of her household. Whereupon the Norwegians selected Haakon, a son of the king of Denmark, as their sovereign, and a daughter of the English king Edward VII became the Norwegian queen.

And now all three Scandinavian kingdoms are as independent of each other as they were at the beginning of their history; there was a century and a quarter of the so-called Calmar Union of all three, nearly three hundred years of union between Denmark and Norway, and nearly a century of union between Sweden and Norway.

IN DENMARK OLD AND NEW

A street scene.

Where Danish kings are buried.



Round Tower, Copenhagen.

The great square in the centre of Copenhagen, the capital of Denmark.

The castle on Lake Frederiksborg.

Shipping at Copenhagen.

DENMARK AND ITS PEOPLE

DENMARK, the smallest of the lands inhabited by the Scandinavian race, has a population of over three and a quarter millions, living in scattered lands whose total area is about twice the size of Massachusetts. These lands, consisting of a peninsula pointing northward (an unusual direction) and about a dozen islands, half of them quite small, block the entrance to the Baltic Sea. There are only three waterways through the islands, the Sound, the Great Belt and the Little Belt. The first is between Sweden and the largest island of Zealand; the second, between the islands of Zealand and Funen; the third, between Funen and the peninsula of Jutland. All are easily commanded from the shores, and really belong to Denmark.

HOW DENMARK'S POSITION AFFECTED HER HISTORY

This position right athwart the entrance to the northern European sea has given Denmark importance on the sea. Only Germany has solved the problem, by cutting the Kiel Canal between the North Sea and the Baltic Sea through the state of Holstein. In the north, Denmark as a controller of waterways resembles Turkey in the south, and so she has been drawn into wars by the attempts of more powerful nations to use her as a well-placed ally, able to hinder the passage of fleets. That was Napoleon's view, but it failed.

Apart from her position astride the seas, and close to very fine fisheries, Denmark has no natural advantages that give her a lead over other nations, though she does lead them in some respects. Where she has succeeded the means used have been the education, intelligence and power of organization of her people. As an agricultural nation she has no superior.

The country is flat, though not with the flatness of fenlands. Its scenery is pleasant but not impressive. The western coast is partly shielded, like Holland, by islands, and its sandy shores have to be guarded against inroads of the sea. Denmark has no mineral wealth that can be used in manufactures, but its soil is for the most part fertile, especially on the islands on which the larger part of its people live. It is fairly well wooded, chiefly with beech, and its agriculturists, on their small farms, by scientific study and finely organized co-operative work and marketing, have won a good name everywhere by the consistent quality of their produce. Danish butter and bacon can be relied on for a sound standard of quality, and so always command a fair selling price. Indeed, the Danes, by intelligent combination, have reached a state of steady prosperity that may well be envied by farming communities that trust to less well-organized methods. Immense quantities of butter, bacon, hams and eggs are sent regularly to the British markets and to Germany.

Denmark supplies largely her own wants in cereal and root crops—potatoes, oats, rye, barley and wheat being extensively grown; and her cattle rearing is successful. Her prosperity, widespread if modest—for she does not produce millionaires—is based on the education and thoughtful industry of her people, and she attains comfort if she falls short of riches.

Physically, the Danes are a fine race, tall and athletically trained. With an easy independence of bearing in the country districts, they have in the towns a conspicuous courtesy in their manners that is a reminder of their friendliness with the French in the past.

The capital, Copenhagen (meaning merchants' haven) stands on the island of Zealand, and has long been a great centre of culture for the western Scandinavian peoples. It has a population of 560,000, or nearly one-fourth of the number in the whole kingdom. The popular King Christian IV added greatly to its importance, and it has very interesting museums and picture-galleries. In appearance it resembles a Dutch city, owing to its flatness, nearness to the sea (it is on the Sound) and its canals. Its memories recall the names of famous Danes, such as Tycho Brahe, the great but eccentric astronomer; Hans Andersen, the charmer of the world's children in fairy lore; and Thorwaldsen, the one great sculptor of northern Europe.

THE DANISH ISLANDS, AND ONE COLONY

Each of the Danish islands has its considerable town, in close touch with seafaring, the most important being Odense, in Funen, with about 50,000 people. On the eastern side of the Jut-

A BIRD'S-EYE VIEW OF LITTLE DENMARK

Denmark, the smallest of the Scandinavian kingdoms, consists of a peninsula with a number of islands, on one of which, Zealand, Copenhagen is situated. Look what a commanding position Denmark has as keeper of the entrance to the Baltic Sea. Russia, the states of Latvia and Esthonia, Poland, Germany and Sweden all depend upon this sea as an outlet for trade, although it freezes in winter.

land mainland are Aarhus, and Aalborg. The nearest seaport to England, on the North Sea, is Esbjerg, and from it Copenhagen is reached direct by rail and ferry. Helsingfors, on Zealand, at the narrowest part of the Sound, which here is only about three miles across, is the ancient Elsinore, famed as the scene of Shakespeare's tragedy Hamlet Prince of Denmark.

Besides the islands which lie between Jutland and Sweden, Denmark includes the island of Bornholm, in the Baltic, and the sheep-rearing Faroe Islands, which are the protruding tops of an undersea ridge between the Shetland Islands and Iceland. The Faroes have an area of 540 square miles and a population of about 21,000.

Iceland itself has links of attachment with Denmark. The king of Denmark is also king of Iceland, and Icelanders have rights of citizenship in Denmark, and Danes similar rights in Iceland. But the island has its own Parliament, and neither Iceland nor Denmark claims military defense from the other.

The island of Iceland is about one-fifth larger than Scotland. It has a population of nearly 100,000, of whom about 18,000 live in the capital, Reykjavik, on the much-indented western coast. The island has many attractions for those who love to see the full variety of the earth's sights. It has the nearest volcano to the British Isles, Mount Hecla, and spouting hot-water springs near the Arctic cold. Its people are singularly attractive in their quiet industry. Among them have been preserved in purest form the oldest legends of the Nordic race.

The neighborhood of Iceland abounds with fish, and is frequented by all the deep-sea fishing fleets of western Europe. Indeed, fish is so much the mainstay of the islands that in severe winters the cattle, sheep and ponies of the island are fed on dried fish, and have become accustomed to an animal diet.

Many of the younger Icelanders are now emigrating to Canada. Before they go they study English in their winter quietude, and they are warmly welcomed for their sterling characters, complete honesty and faithful industry.

Denmark's one colony is Greenland, where 14,500 people live around the coast. The ice-free portion is about as large as England. The mother country retains the trade of the colony under her own control. Greenland is an island extending far into the Polar Sea. It is still topped, in its elevated centre, by a thick cap of ice, as all northern Europe once was covered, but there appears to be a slow lessening of this mountainous coating of ice that in the far future will disappear.

NORWAY AND ITS PEOPLE

AS they are looked at on a map, Norway and Sweden seem to form, in the Scandinavian peninsula, a single, compact country that might well be united in government. But if we look more closely we shall perceive that the lie of the land is against any such unity. Only on the plains of the comparatively low-lying far north, where the reindeer-breeding Finns and Lapps extend from Norway to Russia, is there a clear common interest in life.

Norway and Sweden are tilted away from each other down the slopes of a mountain range that is not easily crossed. The mountains, which are known as the Kjolen, or "Keel," resemble the central keel of a boat when she is turned upside down. The two countries look away from each other. Norway goes down one side, looking west and south, and Sweden goes down the other side, looking east and southeast. Norway is a country of the Atlantic and North Sea; Sweden is a country of the Baltic Sea. Norway has no navigable rivers; yet large ships can steam far into her interior at many places because the western sea winds its way deep into her mountain recesses. Sweden is a broad land of many waters, making a navigable network, and the quieter waters of the Baltic are fenced off from breaking deeply into her shores by a breakwater of small islands. To a large extent Norway has the same rocky defense, but the Atlantic breaks through into the deep valleys which were cut out of the steep western shore of the mountains by the glaciers that descended from the ice-cap once covering Norway. These deeply cut valleys, floored by the Atlantic, are the famous fiords. And still the glaciers remain on the top of the highest parts of the "Keel." Norway has by far the largest glaciers in continental Europe,

QUAINT AND BEAUTIFUL VIEWS OF NORWAY

Timber church at Gol.

Pulpit Rock, Geiranger Fiord.

Trondhjem Cathedral.

Rocky heights above Naerodal Valley.

Old merchant houses, Bergen.

A happy family in the mountains.

Rocky road near Geiranger Fiord.

the largest spreading over 580 square miles of lofty plateau. The largest glacier of all, by the way, is in Iceland.

The Scandinavian mountain range is a lofty plateau much nearer the Atlantic than the Baltic, with ice and snow on its shoulders, at heights of from 4,000 to 5,000 feet, and peaks rising out of the snow to 6,000 and 7,000 feet. Indeed, the highest peak is 8,400 feet. These peaks are the steep heights that have not been covered by the ice-cap which wears down the shoulders of the range.

THE LOFTY PLATEAU WHICH DIVIDES NORWAY FROM SWEDEN

The range divides into two as it goes southward, the chief branch following the Norwegian coast, and the other continuing to form the "Keel" boundary between the two countries as it sinks in height.

So, while Norway and Sweden look away from each other down the short and steep Norwegian slope, and the long and gradual Swedish slope, at the top they halve the line of peaks and plateaus.

Norway is about two and a half times the size of England, but much of it is mountain land incapable of cultivation except in patches. It has a population of over two and a half millions. The Norwegians make the fullest use of their abundant forest lands, the fishing of their dashing mountain streams, and the grazing of their Alpine pastures as the snows retreat, but they are really a seafaring people, as they have been ever since they became known to the rest of the world. The sea fisheries of Norway are of great importance.

The tonnage of Norwegian shipping on the world's waters ranks seventh among the seafaring nations, though Norway has the smallest population. The order is Great Britain, the United States, Japan, France, Italy, Holland and Norway. Norway's commercial fleet is two-thirds as large as that of France, though France has fifteen times her population. It nearly equals that of Holland, though Holland has the trade of great colonies; and it is twice that of Spain with eight times her population.

THE IMPRESSIVE FIORDS NATURE HAS CARVED OUT OF NORWAY'S COASTS

While Norway has scarcely any mineral wealth, it has abundant water-power that may be used in electrically worked industries. Its exports are timber, wood-pulp, fish, ships, paving material and matches.

Many visitors are attracted by the stern and solemn beauty of the fiords. The chief fiords, as we go from the south toward the north, are Christiania Fiord, leading from the Skagerrak up to the capital city; the Bukken Fiord, near Stavanger, leading up to Sand; the Hardanger Fiord, leading to Odde. Then, north of Bergen, the Sogne Fiord to Gudvangen; the Nord Fiord to Loen; the Stor Fiord to Marok; the Molde Fiord to the Romsdal; and Trondhjem Fiord to Trondhjem. Generally, people steam inland, sometimes one hundred miles, to the head of a fiord, and then leave the ship and ride by pony and carriole, or walk, to the head of the next fiord, where they are met by the ship which has threaded its way to sea and ascended the neighboring fiord. The overland journey from fiord to fiord usually takes two days. In this way visitors see something of the country inland as well as along the coasts.

THE KINDLY PEOPLE OF A SMALL AND BEAUTIFUL LAND

Wherever they go they cannot help being attracted by the Norwegian people. Blue-eyed, yellow-haired, tall and well proportioned, they are pleasant to the eye, and their frank speech and honest ways are backed by genuine kindness. No people are kinder to animals than the Norwegians and the Swedes, and the wild creatures know it. Birds are tamer there than in other lands. As for the fawn-colored ponies that draw the little vehicles called carrioles, they are so petted that they become mischievous in the quiet way of the country, and will play the traveler harmless pranks.

Norway is a very beautiful country, though rugged and thinly covered with soil. Its scattered people work hard on their patches of grass land and corn land, in their forests, at their fisheries, and in their small ships at sea, and they are willing to work. The fierceness of their Viking ancestors is no longer to be seen, but the old adventurousness is left. They still roam about the world. Many emigrate, and return with money saved. Their seamen are bold and resourceful. It was a Norwegian, Amundsen, who first reached the South Pole, and Dr. Nansen remains unexcelled as a daring traveler in the Far North.

The Norwegians live in a scattered way, but they educate their children well. Their only large city is Oslo (Christiania),

NORWAY, SWEDEN AND DENMARK

Map of the Scandinavian countries showing very clearly the lie of the land. From the central keel, which almost follows the dotted line, the Norwegian mountains run to the sea, where they end abruptly as high walls to the fiords, or inlets. The Swedish slope, long and gradual, and cut through by many rivers, ends in a low coast. This physical formation is the key to the occupations of the people.

Three smiling maids of Leksand in Sweden.

the finely placed capital. It is a comparatively new city, and modern in every way, with over a quarter of a million inhabitants. Bergen, with over 90,000 people, is the second centre of shipping and business. Other ports are Stavanger, in the south, and the interesting ancient capital Trondhjem, a great centre of the fishing industry. Farther north, opposite the rugged Lofoten Islands, a railway runs from Narvik to Finland and Russia, passing the iron-mines of Lapland. It proved an invaluable line of communication during the World War. Tromsoe, still farther north, is the Norwegian outpost for Arctic sailing. Here the mountains have lessened in height, and the scenery begins to have a depressing effect from its chill barrenness, but many summer visitors continue their journeying to the North Cape, where in the latter half of June the sun may be seen by the tourists at midnight circling the earth above the horizon in unbroken day.

Swedish peasant returning from market.

A family of Lapps at home.

THE BEAUTIFUL WATERWAYS OF NORWAY

The seaport of Bergen in Norway.

The Aurlands Fiord.

Two lakes at different levels.

The Karl Johans Gade, one of the main streets in Oslo, capital of Norway.

SWEDEN AND ITS PEOPLE

SWEDEN, the largest and most populous of the Scandinavian nations, differs from both Norway and Denmark in having abundant mineral resources of fine quality.

It resembles Denmark in its successful agriculture in the south, and Norway in its fine forest lands, which make its export of timber, wood-pulp and paper important, but its mineral products give it a distinction entirely its own.

The central part of the country is extremely rich in iron of exceptional purity. It has also zinc, manganese, sulphur, and some copper, silver and lead. If Sweden had an ample supply of coal it would be one of the leading manufacturing countries in the world. As it is, charcoal has to be used largely in the smelting of its metals. Notwithstanding the lack of coal, its exports of metal goods and machinery rank next in value to its timber and such timber products as wood-pulp.

In size Sweden is about three times the size of England and Wales, and it has a population of six millions. The land has a general southeasterly slope to the Baltic from the wide mountain range which separates it from Norway. It possesses an abundance of navigable inland waters, especially lakes. The great lakes Vener and Vetter in south central Sweden, and Lake Malar near Stockholm, with many smaller lakes, are joined together by a canalized water-system extending to more than seven hundred miles, and the country has a convenient network of railways.

THE LAPLANDERS OF THE NORTH

The northern part of Sweden, in common with a small part of Norway and the northern extension of Finland, is inhabited by a race that is not Nordic—the Laplanders. The Lapps were driven northward by the Nordic invaders in a period beyond history, but probably most of them have lived from time immemorial on the snowy plains of the north, in close association with the reindeer which there finds its natural home. There they maintain a civilization which is entirely their own, and which illustrates the life of man in ages generally studied through geology.

In Sweden and Finland the Lapps are usually divided into fisher, mountain and forest Lapps. In Norway there are sea Lapps, river Lapps and mountain Lapps. The mountain and forest Lapps are the real Lapps. They are nomadic. In the autumn the mountain Lapp builds his wooden storehouse on the edge of the forest, and during the winter he wanders south. About the middle of May he is back at his storehouse, but as soon as the weather grows warm he pushes up to the mountains, and there through the summer pastures his herds and prepares his cheeses. By October he is busy at his hut, killing his surplus reindeer and curing meat. The life of the forest Lapp is similar, save that he never wanders out of a certain district where he has hereditary rights. In spring he lets his reindeer loose, and after midsummer, when the mosquitoes grow troublesome, collects them till August, when they are again let loose until October.

Stockholm, the Swedish capital, is one of the most beautifully situated cities in the world, though it lacks hilly surroundings. It contains one of the most complete historical museums ever devised. If a Swedish novelist wishes to write a Swedish story of any period, in any part of the country, he can find in the museum rooms furnishings and costumes illustrating the lives of the people in that time and place.

Stockholm has a population of 425,000. Its fine national institutions and the beauty of the surroundings make it one of the most distinctive European capitals. The other seaports of Sweden are Gothenburg, the front door of the country, connected with the central parts by canal as well as rail; Malmö, opposite Copenhagen on the Sound; Norköping on the Baltic, south of Stockholm; and Karlskrona, on the southern Baltic. The port of Wisby, on the island of Gothland, has played a prominent part in Swedish history. The most interesting historical town is Upsala, the ancient capital, which has the leading university. Lund, the other university, is in the extreme south.

The Swedes, like the Danes and Norwegians, are among the best educated people in Europe. Many of them speak English. Like their Nordic neighbors, they are also extremely democratic in feeling, and almost exclusively Protestants of the Lutheran type. A large part of the trade of all the three countries of the Scandinavian stock is with Great Britain.

THE NEXT STORY OF ALL COUNTRIES IS ON PAGE 5495.

STOCKHOLM, THE NORTHERN VENICE

The beautiful city of Stockholm, capital of Sweden.

Lumbermen at work on a Swedish river.

The ancient cathedral at Lund.

The great reinforced concrete railway bridge near Orebro.

The medieval castle at Kalmar in Sweden.

The Royal Opera House, Stockholm.

Part of Wisby city wall.

A high-level concrete road bridge over Skarn Sound, near Saltsjöbaden.

These two caterpillars of the silkworm moth, feeding upon mulberry leaves, are shown natural size.

THE WONDER OF A PIECE OF SILK

IT was those wonderful people the Chinese who first discovered the use of silk. They learned that it could be woven into material for dresses, and they learned how to get it from the silkworm. They found that the silkworm could be kept alive in captivity; that it would thrive as a prisoner, if it were kept clean and were fed on mulberry leaves, quite as well as if it were at liberty. So they kept the caterpillars, and when these turned into moths, they kept the eggs that they laid, and when the caterpillars spun cocoons of silk in which to live, they took a certain number of the cocoons and unwound the silk of which they were composed, and made the silk into dresses. What the Chinese were doing with caterpillars nearly five thousand years ago, the people in many countries are doing to-day, and all for the same purpose, that men and women may have silk to wear or to use for the thousand and one purposes for which this beautiful fabric is so much sought.

It is very wonderful to think that all the millions of silkworms that for many years produced the silk upon which the whole of Europe mainly depended came from the batch of eggs brought by two monks from China. This is the story. The art of making silk began, as we have seen, in China. The Chinese guarded their secret as closely as they could. They thought it good that their people should know how to make silk, but they did not want people in other countries to know how to do it. If other people wanted silk, they must buy it from the Chinese, not make it for themselves. They sold a good deal to Rome, for Rome in all her glory could not produce silk for herself.

This state of things lasted until 550 years after the birth of Christ. Then the wise emperor Justinian, who ruled in Constantinople, saw how important was the silk trade, and determined that he would create it in the Roman Empire. Two Persian monks who had long lived in China told him that they had seen the whole process of rearing the silkworms and the manner of treating the silk. So Justinian sent them secretly to China to get some eggs of the silk-moth. They walked all the way from Constantinople to China, and they walked back again, but they brought with them some of the precious eggs.

It would have cost them their lives had the purpose of their visit been known. They knew this and were very

careful. They got a supply of eggs of the silk-moth, hid them in a hollow bamboo, and then carried them to Constantinople and presented them to the Roman emperor, who ruled in what is now the capital of Turkey. The emperor was delighted. The eggs were hatched, and there appeared, for the first time in history, a number of silkworms in Europe. From each female moth he would get five hundred or more silkworms, and from these, in turn, there would be another great increase. The monks had brought him, in a little bamboo nest of eggs, the richest gold-mine that they could have given him.

The emperor caused a silk factory to be set up in his royal palace. Only those whom he appointed were allowed to manufacture silk. But in the course of time the eggs of the silk-moths were carried to other countries. In Italy and France many towns became famous for their silk manufactures. Frenchmen who had been persecuted on account of their religion and had fled to England took with them the secret of manufacturing silk, and after a while silk fabrics began to be made in England, where an important industry quickly grew up. They tried hard to cultivate silkworms in England and in Germany, but never succeeded sufficiently to supply the factories with cocoons.

Early attempts to grow silkworms in America

Before the American colonies became independent, mulberry trees were imported, and attempts were made to grow silkworms, but with little success.

Though the mulberry grows well and the worms thrive, the process demands much labor and constant watchfulness. Labor has been too scarce and wages have been too high to permit the industry to become profitable in the United States. At present renewed efforts are being made in California, and some raw silk is being produced.

About the year 1850 a terrible disease broke out among the silkworms of Italy and France. In spite of the disease there were always some healthy caterpillars producing silk, and the trade never came to a standstill; but the damage done to that part of the trade which failed robbed France and Italy of hundreds of millions of dollars.

It was only then that Europe had to send again to the East for more eggs of the silk-moth. For hundreds of years Europe had been stocked with its millions of silkworms from the descendants of those silkworms which came from the eggs carried away in a little bamboo by the two monks at the command of Emperor Justinian.

How the silkworms are raised from tiny eggs

Raising silkworms is not particularly difficult. Any boy or girl in whose yard a mulberry grows can raise silkworms if he or she can get the eggs and is willing to take the trouble. Many boys and girls have done precisely what is being done in Japan and China or in Southern Europe. Let us see how it is done. The pictures tell almost the whole story.

The moths are encouraged to lay their eggs on sheets of paper. These eggs are very tiny—it takes forty thousand to weigh an ounce—and must be kept in a cool, dry place until the mulberry trees are in leaf. Then the eggs are placed either in the sun or in an incubator, where they soon hatch. The tiny larvæ begin to eat at once and grow rapidly. Within two months they molt, or change their skin, four times and eat several thousand times their original weight of mulberry leaves.

The caterpillar is now about three inches long and eats vigorously for a few days more. Then it prepares for its end. All the time that the silkworm has been growing up, it has been forming and filling two large vessels, or sacs, that run along the sides of its body. In these two sacs is stored a sticky fluid. If we saw it in its natural state—that is to say, the state in which it is while still in the body of the caterpillar—we should not have the least idea as to what it was.

The sticky stream that becomes a strand of silk

That sticky stuff in the body of the caterpillar is to become the marvelous silk which makes the insect so valuable. When it is about to spin, as we call it, the caterpillar ceases to eat. As we watch we see a tiny stream issue from its lower lip. That is the silk issuing from the spinnerets, or seripositors. It is as well that we should know the names so that we may not be puzzled when we meet them elsewhere. We must remember, too, the scientific name of the common silkworm. It is the *Bombyx mori*.

Well, then, the *Bombyx mori* begins to spin its cocoon by producing a tiny stream of silk from its spinneret. The sticky fluid, if we force it from the body of the silkworm, becomes hard at once; but, manipulated by the silkworm, it is drawn out into a beautiful fine strand of silk. Strands from two sacs are joined together by the silkworm to form one thread, and it is only by the aid of the microscope that we are able to discover that there are two in the thread. With this material the silkworm weaves itself the loveliest house of silk.

The work usually takes three days, but may take four, or even five. Little by little the silkworm builds up its castle, weaving it so perfectly that at last the worm is entirely shut in and quite invisible. All the time that it is building, the silkworm works its head round and round in a regular order, never wearying. And all the time the silk never fails.

A DAINTY GLOBE OF SILK THAT LOOKS LIKE A FAIRY EGG

The silkworm, at the beginning of the task, weighs over 90 grains. When the labor is ended, the silkworm, with its cocoon, weighs only about 50 grains. And there it is in a lovely globe of tightly woven silk, looking like some fairy pigeon's egg. The cocoon may be either white or pale yellow. Having watched the spinning, we realize why the silkworms must have plenty of space. If they are at all cramped, two will spin together only one cocoon, and this will be less valuable.

If the cocoons are left, there will come forth, in about fifteen days or three weeks, a moth from each. The average length of the moths is about half an inch, but the males are slightly smaller than the females. They can be kept on a cloth. They eat very little, and sometimes even nothing at all. They mate as birds mate. The females lay five hundred or more eggs and then die, and the males do not live long after them. Their whole lives as moths last but a few days. In that time they never try to fly away. The females cannot fly at all; the males have just enough power in their wings to steady themselves in descending, but they cannot possibly fly upward.

In this we see the result of thousands of years of care and attention on the part of man. The *Bombyx mori* has always been the one species common everywhere as man's silk-producer; there are others in captivity in China and Japan, but they are not of very much importance. The *Yamamai* silkworm of Japan, which eats oak leaves, furnishes excellent silk, and there are many others that furnish a little. Those that have been allowed to remain wild can fly about as well as any other moths. Only those that have been cared for by man have lost the power to fly. If they could fly, they would fly away, and we should never know where to look for their silk.

WHY THE SILKWORM MUST DIE IN ORDER TO GIVE US SILK

So far we have traced the silkworm from the egg to the caterpillar to the moth. What of the silk, of which we have talked so much? Here we come face to face with a little tragedy, for every silk dress that is made means the death of thousands of silkworms. That sounds dreadful, but it is not so in reality. The life of the silkworm is ended when the insect has reached the chrysalis stage. It is then in a stage of torpor and can have no sense of feeling. When the cocoons are all ready it is decided how many moths are needed to renew the supplies of eggs. Some of the best cocoons are taken for the nursery. The others are wanted for silk.

The reelers then steam them, plunge them into boiling water, or submit them to a high dry heat. This kills the chrysalis. The reason why this has to be done is that, if life remained in the chrysalis, the latter would turn into a moth, and would then form an opening at one end of the cocoon out of which to creep, thus spoiling the cocoon for man's purposes.

The next step is to wind the silk on the reels. To do this the cocoon has first to be softened in water which is warm but not hot. The water dissolves the gum that binds the silk together. A neat-handed girl then twirls the cocoons about with a light brush that catches the loose ends and causes them gradually to unwind. All that we have to do is to undo the work that the caterpillar did. But the silk so far is too fine to be wound in this state. In the thinnest part the silk is so fine that two thousand strands of it laid side by side may cover only an inch, while in the thickest part from six hundred to seven hundred would be required to make up an inch in thickness.

SOMETHING THAT THE WISEST MAN CAN DO NO BETTER THAN A BOY

So, when the ends of the silk are discovered, the operator joins the filament from several cocoons together, passes them through a fine eye of glass or polished metal in a winding machine, and letting the cocoons remain in the water, winds away until all the silk that can be used is wound out from each cocoon. As one cocoon is exhausted another is added, so that there is no limit to the length of the filament. The silk is wound on a wheel, or a reel, and care must be taken to see that the strands do not stick together. In Eastern countries and in some parts of Europe machinery so simple that a boy could make it is used; but in big factories they have much improved on this. Still, the principle is everywhere the same, and at this stage the wisest man in the world could do no better than an ordinary boy or girl who has had a little experience with the winding.

Once the silk is freed from the cocoon and wound on reels, it is made into hanks, or skeins, and is ready for the manufacturer. Many processes follow. The silk has to be freed from all the gum remaining on it, for at present it has no lustre such as we expect silk to show. It has to be cleansed by boiling, to be scoured, and purified by acids. That is one way. Another is to let the silk begin its own purification by a process of fermentation, which is done by shutting up the uncleaned silk in tanks containing soapy water, in which it may lie for weeks. Then follow all sorts of washings, and finally a drying.

The silk may be woven just as it comes from the cleaning machine, or it may be doubled and twisted. Finally the silk is ready to be made up into dress materials, or into whatever may be required, just as if it were wool or cotton. A garment of pure silk lasts a very long time, for there are very few things that wear better. Sometimes, however, silk garments, or a silk umbrella become full of slits though they have been little used. This trouble usually arises because the dyeing and finishing have not been properly done.

HOW SILK WASTE BECOMES SPUN SILK

So far we have described how reeled silk is prepared. As you have seen, silk prepared in this way is a continuous filament, but such silk makes up less than half the weight of the cocoon. The outer layers of the cocoon and the layers next to the chrysalis are not reeled. Then, too, there are double or imperfect cocoons, or those from which the moth has emerged and cut through the threads. Then, too, there are threads broken in reeling. All these are called silk waste, and formerly they were thrown away. Now machinery has been invented which saves this material. After thorough washing, the tangled fibres are straightened, trash and foreign material are removed, and what is left is spun into beautiful silk thread in much the same way as cotton is spun. This spun silk is real silk, and for some purposes is as good as, or better than, reeled silk. For others it is not.

WHAT IS RAYON AND HOW IS IT MADE?

Many attempts to make thread similar in appearance and quality to that coming from the silkworm have been made, and during the present century partial success at least has been reached. There are several methods, but the general idea is the same in all of them. Cotton, wood, pulp, or other vegetable matter composed chiefly of cellulose, is treated with certain chemicals. The resulting product is forced through tiny holes in the form of fine threads, which are treated with dilute nitric acid, and then may be spun, woven and dyed just as natural silk. The name Rayon has been adopted for it, and it is even more glossy than real silk, but is not so soft or so strong. However, it is much better than formerly, and much of what is sold for silk in the shops has never been near a silkworm.

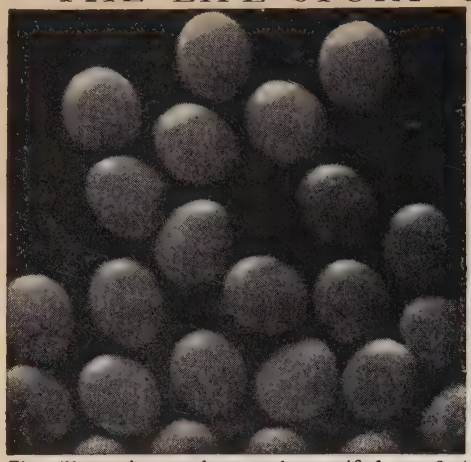
Whether the chemist will be able to improve this substitute for silk so that it will no longer be necessary to take the trouble to cultivate silkworms, is a question we cannot answer yet. So many wonderful things have been done in the way of producing either natural products by artificial means, or producing substitutes for them, that it would be rash to say that any particular thing can never be done. All that we can say so far is that Rayon is not silk, or even artificial silk, but is an imitation of silk (since it does not have the same chemical composition) and that up to the present it is not equal to silk in all respects.

THE NEXT STORY OF FAMILIAR THINGS IS ON PAGE 5429.

PICTURE-STORY OF A PIECE OF SILK

This picture by François Boucher, in the Wallace Collection, shows what beautiful things can be made from the product of an insignificant insect. The most glorious robes are the work of an unattractive caterpillar called by man a worm. In the pages which follow you will be shown the whole process.

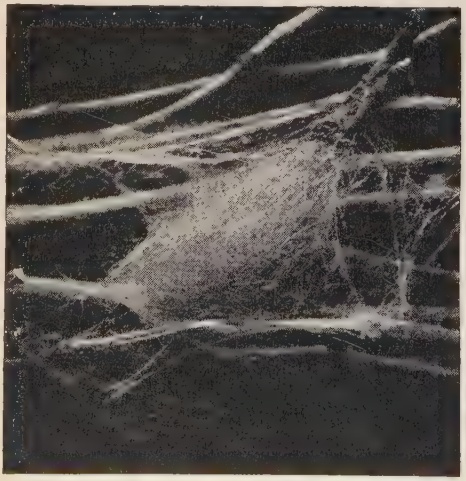
THE LIFE STORY OF THE SILKWORM



The silkworm's eggs, here much magnified, are first bright yellow, and then greenish gray.

Some young silkworms feeding upon the leaves of the white mulberry, their principal food.

Having found a suitable place in which to spin its cocoon, or being provided by the silk farmer with a proper cone, the worm spins its silken bed. These pictures show three stages of the work.

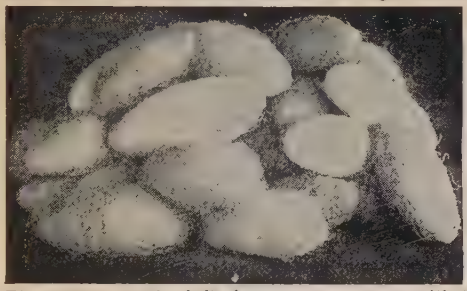


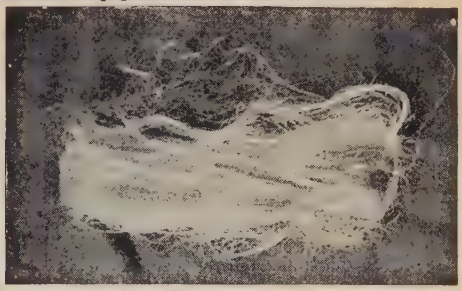
In this picture we see a completed cocoon among the twigs where it has been spun by the worm.

Above is a completed cocoon; below, one with the outer fibres removed to show the inner silk.

HOW THE SILKWORM GIVES ITS SILK

Having spun its cocoon, the silkworm, which is not really a worm but the caterpillar of a moth, changes into a chrysalid, or pupa. On the left we see a cocoon cut open, showing the pupa and the old skin of the caterpillar, and on the right are a number of pupæ removed from the cocoons.





The picture on the left shows some cocoons with the coarse outside silk removed. These cocoons are now ready to have their silk wound off into skeins, and we see a completed skein on the right.

A boy can make this simple winder. The cocoon is placed in a vessel containing warm water, A, and the strands of silk, B, are wound round the drum, D, turned by the handle, C.

Photographs on these pages by Henry Irving, Percy Collins, Underwood & Underwood, and Keystone View Co.

THE SILKWORM HATCHES FROM THE EGG

The moths are induced to lay their eggs on large sheets of paper which are treated to prevent them from hatching before the mulberry leaves grow.

When the leaves are on the trees, the eggs are placed either in the sun or in an incubator so that the heat may hatch them. © Keystone View Co.

Here Japanese girls are gathering leaves in a mulberry grove. The appetite of the silkworm is almost incredible.

When the silkworms have hatched they are placed on frames, and fed day and night on mulberry leaves.

COCOONS OF SILK READY TO BE WOUND

This picture shows the silkworm's work completed. The cocoons have been spun on layers of grass or straw. The cocoons are completed by the silkworm in seven days and are then ready for use.

© Underwood & Underwood.

Silk is produced in considerable quantities in Syria, and these cocoons are being laid out to cool and dry. The photograph was taken at Antioch, where the disciples of Jesus were first called Christians.

REELING THE SILK OFF THE COCOONS

The cocoons are examined, and the best are set aside for carrying on the race of silkworms.

The chrysalids are destroyed by placing the cocoons in an oven, where they are suffocated.

The woman on the right is reeling the silk from the cocoons which are in vessels of water behind her. On the left the silk is being made into skeins.

TWISTING THE SILK INTO THREAD

Here the silk obtained from the cocoons is being wound on bobbins in a French factory.

Here the silk that has been wound is being spun into silk yarn in a great French factory.

Much silk is produced in India, and these women, in a village of southern India, are spinning silk by means of very primitive spinning-wheels, such as have been used there for hundreds of years.

WEAVING THE SILK INTO CLOTH

This weaver in a Japanese home is producing by hand labor some of the beautiful fabrics for which Japan is noted. This method, however, is fast giving place to the factory methods shown on the next page.

A more elaborate loom, though much less complicated than those used in factories.

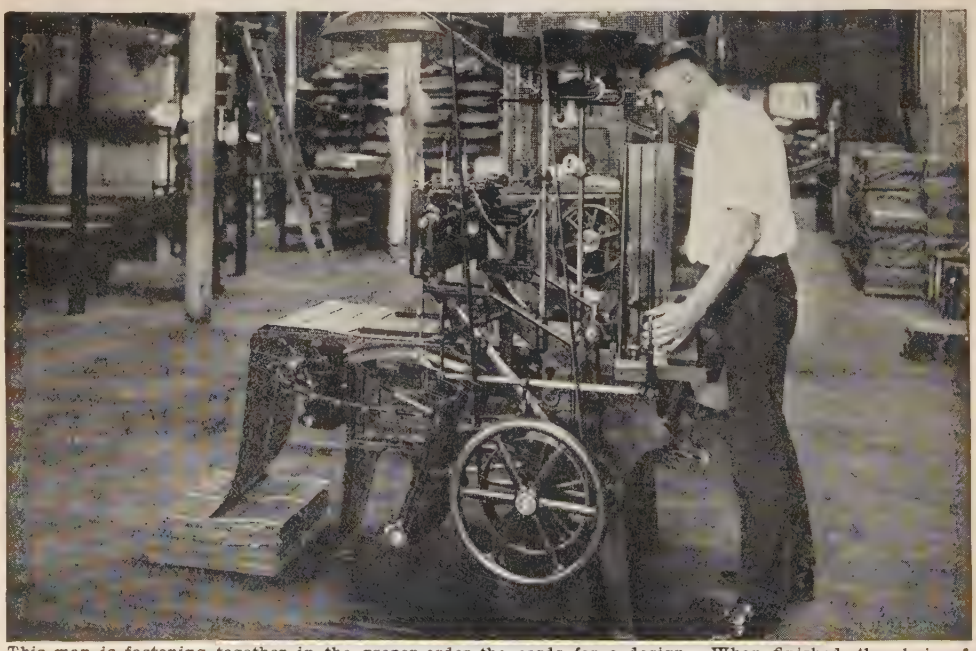
The weaver who produced the silk for the wedding dress of Princess Mary, daughter of George V.

INSIDE A JAPANESE SILK FACTORY

The Japanese are the greatest producers of silk in the world, having outstripped the Chinese, from whom they learned the art. This picture shows the inside of a great Japanese silk factory. No space is wasted.

PREPARING CARDS FOR A JACQUARD LOOM

This man is cutting the cards for a Jacquard loom. The pattern is before his eyes and he is punching holes corresponding to it through the stiff cards. Each card represents only a tiny bit of the pattern, and many cards are required to make a large design.



This man is fastening together in the proper order the cards for a design. When finished, the chain of cards will be put in the loom. The needles pass through the perforations and the most elaborate design can be woven. Sometimes as many as thirty thousand cards may be necessary for a complicated design.

Photographs, courtesy Duplan Silk Corporation, New York City.

MAKING USE OF THE SILK WASTE

In the old days the refuse from silk was thrown away, but now it is all carefully saved and sent to a factory which weaves it into fabric. Here we see the waste arriving.

The waste is first cleaned and dressed, as it is in a very soiled condition, and this is a rather lengthy process. Then it is spread out as shown in this picture.

Gradually, after a number of processes, the slivers, or threads, of silk are drawn out evenly into orderly lengths, as shown in this picture, and these are spun into yarn ready for the weaver, who produces a beautiful silky cloth.

THE OLD MAN TOLD THEM THE STORY

The old man told the story of Humpty Dumpty, who fell downstairs, and yet came to the throne and won the Princess. The children clapped their hands. The fir-tree stood, meanwhile, quite silent.

THE DISCONTENTED FIR-TREE

FAR away in the deep forest there once grew a pretty Fir-tree. The sun shone full upon him, the breeze played freely around him, and in the neighborhood grew many companion fir-trees, some older, some younger. But the little Fir-tree was not happy.

"Oh, that I were as tall as the others are," sighed the little Tree, "then I should spread out my branches so far, and my crown could look out over the wide world around! The birds would build their nests among my branches, and when the wind blew I should bend my head just as the others do."

The wood-cutters came in the autumn and felled some of the largest of the trees; this happened every year, and our young Fir, who was by this time a tolerable height, shuddered when he saw those magnificent trees fall with a tremendous crash to the earth. They were laid in wagons, and horses drew them away, far, far away from the forest.

Where could they be going? What might be their fortunes?

Next spring, when the Stork returned from abroad, the Tree asked him, saying: "Know you not whither they are taken?"

The Stork looked thoughtful, then he nodded his head, and said:

"As I was flying from Egypt to this place I met several ships with splendid masts. I have little doubt that they were the trees you speak of; they smelled like fir-wood. They sailed gloriously, quite gloriously!"

"Oh, that I, too, were tall enough to sail upon the sea!" sighed the Fir-tree.

"Rejoice in thy youth!" said the Sunbeam. "Rejoice in thy youth, in the fresh life that is within thee!"

And the Wind kissed the Tree, and the Dew wept tears over him; but the Fir-tree understood them not.

When Christmas approached, many of the young trees were felled; they were chosen from the most beautiful, their branches were cut off, and they were taken away.

"Where are they going?" asked the Fir-tree.

"We know! We know!" twittered the sparrows. "We peeped in through the windows of the town below! We know where they are gone! We looked through the window-panes, and saw them planted in a warm room, decked out with such beautiful things—gilded apples, candies, playthings, and hundreds of bright candles!"

"And then?" asked the Fir-tree, trembling in every bough. "And then? What happened then?"

"Oh, we saw no more! That was beautiful, beautiful beyond compare!"

"I wish I might be so fortunate,"

cried the Fir-tree with delight. "This is far better than sailing over the sea. How I long for Christmas to come!"

"Rejoice in our love!" said the Air and the Sunshine. "Rejoice in thy youth and thy freedom!"

But rejoice he would not. He grew and grew, in winter as in summer; he stood there clothed in thick dark green foliage; the people that saw him said: "That is a beautiful tree!" and next Christmas he was the first that was felled. The ax struck sharply through the wood, the Tree fell to the earth with a heavy thud; he suffered an agony, a faintness that he had never expected; he quite forgot to think of his good fortune, he felt such sorrow at being compelled to leave his home; he knew that he should never see again those dear old comrades, or the bushes and flowers that had flourished under his shadow, perhaps not even the birds. Neither did he find the journey by any means pleasant.

When the Tree first came to himself he was in a large room. Pictures hung on the walls, and on the mantelpiece stood large Chinese vases with lions on the lids; there were rocking-chairs, silken sofas and tables covered with picture-books. The Fir-tree was planted in a large cask filled with sand, and hung with green cloth, and placed upon a carpet woven of many gay colors. Oh, how the Tree trembled! What was to happen next? A young lady, assisted by two children, began to adorn him.

Upon some branches, they hung little nets cut out of colored paper, every net filled with candies; from others, gilded apples and walnuts were suspended, looking just as if they had grown there; and more than a hundred little wax tapers, red, blue and white, were placed here and there among the boughs. Dolls that looked almost like men and women seemed dancing to and fro among the leaves, and highest, on the summit, was fastened a large star of gold tinsel.

"This evening," they said, "it will be lighted up."

"Would that it were evening!" thought the Tree. "Would that the lights were kindled, for then—what will happen then? Will the trees come out of the forest to see me? Will the sparrows look in through the window-panes?"

At last the candles were lighted, and then, suddenly, both folding doors were flung open, and a troop of children rushed in as if they were going to jump over him; the older people followed more quietly. The little ones stood quite silent, but only for a moment; then their jubilee burst forth, and they shouted with joy till the walls re-echoed.

The children danced and played about with their beautiful playthings taken from the Tree, and no one thought any more of him except the old nurse, who came and peeped among the boughs; but it was only to see whether, perchance, a fig or an apple had been left among them.

"A story! A story!" cried the children, pulling an old man toward the Tree.

And then the old man told the story of Humpty Dumpty, who fell downstairs, and yet came to the throne and won the Princess. And the children clapped their hands. The Fir-tree stood, meanwhile, quite silent and thoughtful; the birds in the forest had never related anything like this. "Humpty Dumpty fell downstairs, and yet was raised to the throne and won the Princess!" "Ah, ah! Who knows but I may fall downstairs and win a princess?"

In the morning the maids came in.

"Now begins my state anew!" thought the Tree. But they dragged him out of the room, up the stairs, and into an attic-chamber, and there thrust him into a dark corner where not a ray of light could penetrate. "What can be the meaning of this?" thought the Tree. And he leaned against the wall, and thought, and thought. And he had plenty of time for thinking it over, for day after day and night after night passed away, and yet no one ever came into the room. At last somebody did come in, but it was only to push into the corner some old trunks; the Tree was now entirely hidden from sight and apparently entirely forgotten.

"It is now winter," thought the Tree. "The ground is hard and covered with snow; they cannot plant me now, so I am to stay here in shelter till the spring. I only wish it were not so dark and so dreadfully lonely! Oh, how pleasant it was in the forest, when the snow lay on the ground and the hares scampered about!"

"Squeak! squeak!" cried a little mouse, just then gliding forward. Another followed; they sniffed about the

Fir-tree, and then slipped in and out among the branches.

"It is horribly cold!" said the little mice. "Otherwise it is very comfortable here. Don't you think so, you old Fir-tree?"

"I am not old," said the Fir-tree; "there are many who are much older than I am."

"How came you here?" asked the mice, "and what do you know? Tell us about the most delightful place on earth. Have you been into the store-room, where cheeses lie on the shelves, and bacon hangs from the ceiling, where one can dance over tallow candles, where one goes in thin and comes out fat?"

"I know nothing about that," said the Tree, "but I know the forest, where the sun shines and where the birds sing!" and then he spoke of his youth and its pleasures. The little mice had never heard anything like it; they listened so attentively and said: "Well, to be sure, how much you have seen! How happy you have been!"

"Happy!" repeated the Fir-tree, in surprise; and he thought a moment over all that he had been saying. "Yes, on the whole, those were pleasant times." He then told them about the Christmas Eve when he had been decked out with cakes and candles.

"Oh," cried the little mice, "how happy you have been!"

The next night the little mice came again and brought with them four other little mice, who also wanted to hear the Tree's history, and the more the Tree spoke of his youth in the forest, the more vividly he remembered it, and said: "Yes, those were pleasant times! But they may come again, they may come again! Humpty Dumpty fell downstairs, and yet, for all that, he won the Princess; perhaps I, too, may win a princess"; and then the Fir-tree thought of a pretty little Birch-tree that grew in the forest, a real princess, a very lovely princess was she to the Fir-tree.

"Who is this Humpty Dumpty?" asked the little mice. Whereupon he related the tale; he could remember every word of it perfectly; and the little mice were ready to jump to the top of the Tree for joy.

But at last the little mice all scampered away, and the Tree sighed: "It was pleasant when they sat round me, those busy little mice, listening to my words. Now that, too, is all past! However, I shall have pleasure in remembering it, when I am taken away from this place."

But when would that be? One morning people came and cleared up the attic; the trunks were taken away; the Tree, too, was dragged out of the corner; they threw him on the floor, but a servant picked him up and carried him downstairs.

"Now life begins again!" thought the Tree. He felt the fresh air, the warm sunbeams—he was out in the court. The court joined a garden. Everything was so fresh and blooming, the roses clustered so bright and so fragrant round the trellis-work, the lime-trees were in full blossom.

"I shall live! I shall live!" He was filled with delightful hope; he tried to spread out his branches—but, alas! they were all dried up and yellow. He was thrown down upon a heap of weeds and nettles. The star of gold tinsel that had been left fixed on his crown now sparkled in the sunshine.

Some merry children were playing in the court, the same who at Christmas-time had danced round the Tree. One of the youngest saw the gold star, and ran to tear it off.

"Look at it, still fastened to the ugly old Christmas Tree!" cried he, tramping upon the boughs.

And the Tree looked on all the flowers of the garden, and wished from his heart that he had been left to wither alone in the dark corner of the attic. He called to mind his happy forest life, the merry Christmas Eve, and the little mice who had listened so eagerly when he related the story of Humpty Dumpty.

"Past! All past!" said the poor Tree. "Had I but been happy, as I might have been!"

And then the servant came and broke the Tree into small pieces, heaped them all up together, and set fire to them, and the poor Fir-tree was no more.

A sad little story of discontent: small and safe he had longed to be tall, though the swallows had told him the fate of the tall spars sailing the seas; then, instead of rejoicing in his youth and freedom, he had pined to be sacrificed to the unknown joys of Christmas. One brief hour of glory was all he had sense to enjoy.

BLACK DIAMOND

THE LITTLE MARE THAT LIVED DOWN A MINE

SHE was a little black mare, black all over, with just a splash of white hair in the middle of her forehead. She had a black mane, a black tail and black hoofs; but, because of the white splash on her brow, they called her Diamond.

She lived in Wales and her master was a grain merchant. She pulled his yellow cart with red wheels through green lanes and over mountain roads, carrying sacks of barley-meal from the mill to the shop, and sacks of grain from the shop to the farmers' houses. A great many people knew Diamond, and children in the neighborhood very often played at being Diamond. They would run about with their heads bent down to their chests and their shoulders pressed forward, pulling at the toy reins which the driver held very tightly, while he said: "Whoa, Diamond; steady, Diamond"; and then they would stand still, pretending that they were waiting while the cart was being filled and would toss their heads up and down, just like Diamond.

But one day, one cold, bitter winter day, poor Diamond slipped on some ice as she came rattling downhill, and fell with a great thud on the road. The beautiful harness, with its red and white brow-band and its shining brass, split like string; the shafts snapped like firewood; the driver was pitched on his head and lay unconscious in the road; poor Diamond, with her knees bleeding and her beautiful soft nose all scratched and dabbled with grit and blood, rolled and kicked and groaned on the hard road, while one of the broken shafts pressed its jagged edges into her heaving flank.

Diamond was so badly injured that it seemed best to put her out to grass.

"She shall have a foal and live light for a couple of years," said the merchant. And Diamond was turned out to pasture. She had lived in this way for two or three months when her master and a stranger entered the field one day. They had a good look at her, stroked her, felt her legs, ran their hands over her sides, examined her feet, and then walked slowly away talking money.

Diamond wondered what was going to happen. She was not long kept waiting. The very next day the two returned, a bridle was pushed over her ears, a rope was fastened to it, and she was led out of the field. A cart stood waiting in the road. The strange man got up in this cart, and took the rope in his hand.

"She's a good mare," said Diamond's master, "and I'm sorry to lose her."

"She'll serve my purpose all right," said the other; and off went the cart with Diamond trotting behind.

They came presently to black and ugly country, with freight cars and engines clanking over lines that stood up from the ground like furrows in a field. Then Diamond saw, in the open air, immense chimneys, and wheels with belting attached to them spinning round and round, and wooden huts, and piles of black coal and great banks of stones, and men, with faces like negroes and clothes like chimney-sweeps, going constantly to and fro.

She was taken to what looked like a wooden shed, and there the man in the cart was joined by three or four others, who looked over her, stroked her, and pulled her ears. The men with black faces looked at her as they passed, and one of them called out: "Take your last look at the sun, old girl!" Some of the others laughed; some looked sad and passed on without speaking.

A bandage was tied over the eyes of Diamond. She could see only a dim and obscure light through this heavy covering. Someone patted her. "Come on, old lady," said a voice. She was led forward. She went nervously, feeling her way, and sniffing suspiciously. Someone was patting her side; the man who was leading her stroked her neck. Suddenly her feet struck on wood, instead of the ground, and she started to one side. "Steady, old girl, steady!" said two or three voices. The hand at the bridle pulled steadily forward. Diamond went on a step or two, sniffing and trembling, her flesh twitching with nervousness. "Whoa, there," said the voices. And she stood still. She heard a heavy door shut behind her, and jumped to one side, crouching down with her hindquarters, her tail pressed between her legs. The man holding her bridle spoke to her

and stroked her. Then he called out: "All right. Let her go."

There was a pause; then the noise of a chain sounded, and Diamond felt herself falling through the earth. Down and down she went, and, in her fear, she plunged to this side and that side, blowing great clouds of steam through her trembling nostrils, while a thick sweat broke out from her heaving flanks.

"It's all right, Diamond," said the voice of the man; and his hand passed quietly over her neck and under her muzzle. When the bandage was taken

BLACK DIAMOND TOLD HER BABY ABOUT THE WONDERFUL WORLD ABOVE THE COAL-MINE

off Diamond's eyes, she found herself in a perfectly black world, which was without grass or sky. She could see nothing. She could scarcely breathe. Then, as her eyes got used to this underworld, she saw that the place was a black tunnel, with walls, roof and floor, and that, in the distance, a light was shining from a lamp.

She was led forward, and soon the light of many lamps fell on her, and she saw men moving and heard the sound of voices. Someone came forward, took the rope from the man who had brought her down and led her away.

Diamond felt less frightened when she saw another horse pulling a truck full of coal through one of the tunnels. She felt almost safe when she came to a stable where there were three other horses. The stalls were clean. There was plenty of straw about. The horses were well groomed and looked fat. They neighed a welcome to Diamond, and Diamond answered them.

She was given some oats, but she was afraid of the manger and would not eat. The man brought some hay for her rack, but she started away from it. Then the man said: "Diamond, my dear lady, a man and a horse can get used to anything. You'll get as used to eating food under ground as above ground, see if you don't." He began to pass a haywisp over her, and while he did so he said: "Now, just you listen to me, my pretty. I'm called William—that's the name you'll have to call if you want anything; just you say 'William,' and I'll be round in a second; my name's William, and I've been here for seven and thirty years, and I never yet handled a horse that didn't get to love me. You've got to love me. I'm going to change your name to begin with, and call you Black Diamond, because you'll

be dealing in black diamonds for the rest of your days.

"Now, it's a bit stuffy down here, I admit; and the dark tries the eyes, and you can't help missing the birds, and the trees, and the grass, and the skies, and the rivers and the sight of children. But, lor' bless you, Black Diamond, we can't all have the best of things. Some must live in palaces, and others in coal-mines. Some must sail ships across the sea, and others must look after poor men in prisons. Some must go fighting, and others must sell shoes. If everybody had everything, there'd very soon be nothing for nobody. And, come to think of it, my lass, you're a deal better off down here with old William than you would be pulling a cab through the streets of London or standing for an hour at a time in the rain outside Cardiff Station.

"Now, isn't that true? Come, taste these oats out of my hand, and see how good they are. You and I are going to be friends; we've got to be friends, Black Diamond. So let's begin at once, and enjoy ourselves."

Black Diamond learned that the love of the miner does make up, in some measure, for the loss of sunlight and heaven's sweet air. She grew to love her friend William. She pulled the coal-trucks through the black mine, and scarcely noticed that she was going gradually, gradually blind. William brought her apples and carrots in his coat-pocket, and the other miners made a pet of her, and she was soon a favorite with the other horses in the stall. "A pit's a poor place to live in," reflected Black Diamond; "but it's wonderful what a little love will do."

She worked faithfully, ate heartily, and slept soundly. But in spite of all this she was going gradually blind.

Then her foal was born, and the miners called it Little Diamond, and Black Diamond grew very happy, telling this black baby all about the wonderful world above the coal-mine. She had just sufficient sight to see her baby, and she would lick it for hours, with her poor, fading eyes full of great tears.

"I like to hear your stories," said Little Diamond; "but, of course, I don't believe they're true. They are only fairy stories, aren't they?"

It is so difficult, when one is born in the dark and lives in the dark, to believe that just a little way above there is a world bathed in light and sunshine.

And years afterward, even Black Diamond herself came to think that the green earth, with its sunshine and rain, where she had spent so many delightful days, must be only a dream.

IDUNA AND THE GOLDEN APPLES

IN the ancient days the English people lived in a country between Denmark and Germany. They were then a fierce race of heathen warriors and seafarers. They loved the noise of battle and the hazards of adventure, and they worshiped savage deities of thunder and war. But though they were rough and wild, and scorned the arts of peace, they loved to hear songs about brave men and beautiful women, and this side of their character is shown in the stories they used to tell about Bragi and Iduna and the golden apples.

Bragi, the tall and comely god of poetry, dwelt with other gods in Asgard, a land of eternal spring, that shone with its golden battlements far up in the sunlit sky. Bragi had a harp with golden strings. When he took it in his hands, and began to sing to the music he made, all the gods put everything aside and listened with delight to him. His voice was very sweet, and nobody could resist it.

Sometimes Bragi would come down from Asgard and wander about the earth. One day he sailed to an island where all the air was sweet with the flowers of spring. There he sang of the joy of life and the power of love; and as he sang, a maiden, crowned with blossoms and leaves, rose up before him, among the flowering grasses and the budding bushes.

She was Iduna, the spirit of eternal youth, fair as the daybreak and pure as running water. She guarded the enchanted tree on which grew the golden apples of immortality.

When Bragi saw her, he sang with such joy that the sound of his voice filled the nine worlds. Then he stretched out his arms to Iduna and she came to him. After they were married, they went to Asgard. The gods welcomed Iduna with

joy, and she gave them some of her apples to eat, and they were filled with the gladness of immortal youth. Unhappily, an old and ugly giant, living in the bleak and wintry land of Thunder, heard of the arrival of Iduna at Asgard, and resolved to obtain one of her apples, so that he might eat it and become young and beautiful. He seized one of the gods, Loki, who came near his domain, and held him a prisoner until he promised to bring Iduna to him. Loki returned to Asgard and found Iduna alone, Bragi having gone off alone on a long journey.

"Come with me, Iduna, out of Asgard gate, and I will show you a tree that bears golden fruit resembling your wonderful apples," said Loki.

Iduna followed him, and Loki led her to the giant, who carried her off to the land of Thunder. For some time the other gods thought Iduna had gone on a journey with Bragi. But time passed, and their hair began to turn gray, and their faces to grow white and withered, because they had no apples of immortality to eat. Then they began to search for her, and found that she was last seen walking out of the gate with Loki, and the traitor confessed that he had persuaded her to go with him to the land of Thunder, but promised to bring her back if he were given a pair of wings.

His request was granted. Swiftly he flew to the land of Thunder, and there he found Iduna sitting in a bare hut very sad and lonely. Happily, the giant was away. But just as Loki started to carry Iduna back to Asgard, the monster appeared. He was very, very angry, for he had not succeeded in persuading Iduna to give him one of her apples, and, putting on an eagle's dress, he rushed after the fugitives like a storm.

IDUNA GAVE THE GODS SOME OF HER GOLDEN APPLES AND THEY RECOVERED THEIR YOUTH

This picture is reproduced from the painting by J. Doyle Penrose, with the artist's permission.

All the gods stood on the battlements of Asgard, anxiously watching the chase. Loki came along at a marvelous speed, but as he neared the gate the giant overtook him and sprang upon him. He sprang too late, however, for the other gods came to the rescue, and slew him before Asgard gate.

Iduna gave them all some of her apples, and they recovered their beauty and their youth; and soon afterward Bragi returned, and sang a song of triumph, and all the gods were pleased and happy as of old.

THE NEXT STORIES ARE ON PAGE 5439.

FRENCH—THE PARTY GOES SHOPPING

First line, French; second line, English word; third line, as we say it in English.

La bonne dit à maman que Jeannette a besoin de chaussures neuves.
The nurse says to Mamma that Jenny has need of shoes new.
Nurse tells Mamma that Jenny needs new shoes.

Maman lui dit de nous mener au magasin pour en acheter.
Mamma to her says of us to lead to the shop for of them to buy.
Mamma tells her to take us to the shop to buy them.

Nous sortons après le déjeuner.
We go out after the lunch.
After lunch we set out.

Nous sommes impatients de voir les magasins.
We are impatient of to see the shops.
We are anxious to see the shops.

Nous entrons dans un magasin et la bonne dit: "Je désire voir des chaussures."
We enter in a shop and the nurse says: "I desire to see some shoes."
We go into a shop and nurse says: "I wish to see some shoes."

Le commis nous en montre une paire, mais elles sont trop serrées.
The clerk us of them shows a pair, but they are too tight.
The clerk shows us a pair, but they are too tight.

Le commis en apporte des autres et Jeannette tend son pied.
The clerk of them brings some others and Jenny extends her foot.
The clerk brings some others and Jenny holds out her foot.

Tout à coup elle crie: "Regardez! La petite souris!"
All at blow she cries: "Regard! The little mouse!"
Suddenly she cries out: "Look! There is a little mouse!"

Elle a peur.
She has fear.
She is afraid.

La petite souris saute par-dessus la chaussure et court derrière des boîtes.
The little mouse jumps by over the shoe and runs behind some boxes.
The little mouse jumps over the shoe and runs behind some boxes.

Nous éclatons de rire.
We burst of to laugh.
We burst out laughing.

Je trouve que les filles sont si bêtes.
I find that the girls are very silly.
I think girls are very silly.

Enfin Jeannette choisit de jolies chaussures, et la bonne paye la note.
At last Jenny chooses of pretty shoes, and the nurse pays the bill.
At last Jenny chooses some pretty shoes, and nurse pays the bill.

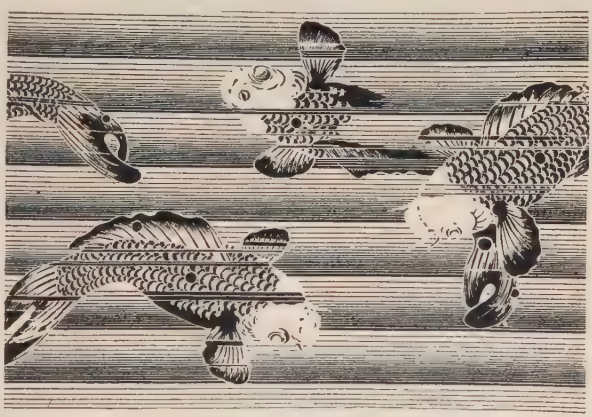
THE NEXT FRENCH STORY IS ON PAGE 5528.

BLUE-PRINT OR SEPIA-PRINT PICTURES

YOU have been told how to take good pictures without a camera on page 2739. Another simple phase of photography is that of blue-printing or sepia-printing. This method offers splendid possibilities to any boy or girl who will spend a small amount of time and a little money on this fascinating art. A large and varied collection of pictures is easily made. Then, too, the results will be entirely satisfactory if care is taken both in selecting and in taking the pictures.

The necessary blue- or sepia-print paper may be bought from the local photographer or any photography supply house. It cannot be kept long, however, unless the greatest care is taken to exclude all light and air. It is well for this reason to keep the paper under a heavy iron or stone weight when it is not needed. This prepared paper may be bought either by the roll, by the yard or by the package, which contains sheets cut to the desired size. An idea of the small cost may be had from the fact that any reliable firm will furnish blue-print paper in ten-yard rolls, twenty-four inches wide, for from $1.25 to $1.50 a roll.

For your first few pictures you will find it easier to make prints from leaves and flowers. After you have selected the most beautiful specimens, carefully arrange them on the glass of an ordinary printing - frame, which should have a clear glass and a back to keep out all light. Next, the paper on which it is to be printed should be placed with the sensitized surface next to the specimens. This paper should be prepared beforehand in a dark room, and the group should be carefully arranged so that the paper can be placed in the frame quickly without exposing it unnecessarily to the light.



A blue-print of a Japanese stencil.

After the specimens are arranged, place the frame in the sunlight for a few minutes, the time varying from one to three minutes, depending entirely upon the condition of the paper and the directness of the sun's rays. When the exposed spaces seem dark enough, the back of the frame should be removed and the paper taken out. Then immediately immerse in clean running water and wash until the unexposed parts are white and the background a clear blue or brown, as the case may be. Then spread on a blotting-paper or cloth to dry. The blue- or sepia-print is then trimmed to the right size to make the relation of masses as attractive as possible. Very attractive compositions are made in this way, and can be used by mounting for different purposes. Of course some care must be exercised in choosing the plant, for a large flower with a

bulky calyx cannot be pressed closely enough to keep out all the light from behind the petals, and will make an indistinct print. It is sometimes well to trim away part of the plant.

Good copies of mechanical or free-hand line drawings which have been made with India ink or with pencil on thin Japanese paper may be made by this same method of blue- or sepia-printing. Satisfactory prints of Japanese stencils, as shown in the accompanying picture, may be made by laying the stencil on the glass of the printing-frame and placing the sensitized surface of the print paper next to the stencil. It is then exposed to the sunlight until the background has reached the desired shade. You will soon learn by experience just when the print should be removed from the frame, but if desired you may place a few narrow strips of the paper under the edge of the frame to be drawn out for testing purposes. In any case when the print is removed it should be washed until it is clear.

Likewise prints of masterpieces may be made if good prints are available from which to make negatives. Although blue-print and sepia-print papers are used in the same way, the latter will give a pleasing brown-and-white composition instead of the blue-and-white.

With a little practice one can make his own blue-print paper by using the following formula: Soluble iron citrate, ¼ ounce, red prussiate of potash, ¼ ounce. Grind both of these to a fine powder. Pour over this 2½ ounces of water and let the crystals dissolve. This should be done in a dark room, for daylight quickly changes the solution and makes it useless. Now, either with a sponge which is quite dry or with a brush, cover one surface of the paper to be used. Paper for this purpose should have a firm calendered surface for best results. But in large masses interesting effects can be secured with water-color paper of rougher texture. After covering the surface evenly, either hang it up or lay it away to dry.

SOME EXERCISES TO PRACTICE AT HOME

PERHAPS some of us are quite tired of hearing the words "Don't stoop," and most likely when we do hear them we only straighten up for a few minutes, and then the head sinks, the shoulders come forward, and the back rounds as badly as ever again. It may be necessary, if we are really too fatigued to hold ourselves up, to lie down flat for a short time in order to rest our muscles; but it is our regular daily exercises that will be most helpful toward strengthening the muscles and curing the stooping, if we make up our minds that they shall be cured.

So let us set to work again and take our exercises before a mirror if possible, to make sure that we are carrying out the directions given and are correctly copying the pictures that illustrate them.

I. BREATHING

Attention. (1) Place first finger of left hand on left nostril, so as to close it; (2) breathe in deeply through right nostril; (3) release left nostril and close the right with right forefinger, and breathe out slowly through left nostril; (4) do the exercise again, this time breathing in through the left nostril, and out through the right. Repeat three or four times alternately.

II. ARM EXERCISES

Attention. (1) Arms upward bend; (2) arms forward stretch, the arms and hands the width of the shoulders apart, palms facing, fingers and thumbs straight, arms straight and level with the shoulders, body upright; (3) return to arms upward bend, always keeping the shoulders back; (4) repeat several times, being careful to stretch out as far as possible, and to return smartly to perfectly correct position; (5) from arms upward bend, proceed to arms stretching downward, with vigor, palms turned to sides, fingers straight, shoulders well back; (6) return vigorously to arms upward bend; (7) add these two exercises to those already learned, and proceed thus—from arms upward bend, arms forward stretch, return; upward stretch, return; sideways stretch, return; downward stretch, return. Repeat this exercise several times, and see that you stretch well and return smartly. The exercise can be slightly varied by doing each movement three or four times before passing on to the next.

III. FEET EXERCISES

Attention. Feet full open, hips firm. (1) Feet placing outward; place the left foot about two foot-lengths in the direction in which the toe points when standing at full open, bending the knee of left leg slightly, and keeping the right straight, dividing the weight of the body equally between the two legs; let the toe touch the ground first; head well up, chin in; (2) return to full open position, taking care not to drag the returning foot; (3) repeat movement, this time with right foot; (4) add this exercise to those already learned, thus—feet placing sideways, return; forward, return; outward, return; repeating several times.

IV. TRUNK EXERCISES

Be particularly careful to breathe gently and quite naturally all the time that you are doing these exercises; never hold the breath. Trunk bending backward, feet astride, hips firm. (1) Raise the chest and bend the upper part of the spine slightly backward, the head being carried back with the body; keep the knees straight, and do not bend the body from the waist; (2) return to first position by trunk upward stretch; (3) repeat several times, bending a little farther back as the exercise becomes easier, but always from the top part of the spine; (4) add this exercise to those already learned, and proceed thus—trunk bending backward, return; forward, return; trunk turning left, return; right, return. Repeat several times.

V. BREATHING

(1) Start with the arms by the side, palms inward; (2) breathe in as the arms are turned backward, pressing the shoulders back till the palms are outward; (3) breathe out as the arms are turned back again to the first position.

MUSIC FROM DRINKING-GLASSES

WHEN we consider that music really consists of regular wave movements passing through air or some other medium, it does not surprise us to find that if we can make sound waves vibrate through a substance like glass, we hear a musical note. Musical instruments are played by striking, plucking, rubbing or blowing; and we can get a musical note out of a tumbler by tapping it or by rubbing it. When we rub the strings of a violin with a bow we make the strings vibrate; and the vibrations pass off into the air in all directions, some of them reaching the drums inside our ears.

It is possible to see with our eyes how wave movement and sound are connected with each other. If we get a thin goblet or wineglass and tap it gently with the thumb-nail or with the back of a knife, it gives out a sound that is a clear note, and which we can name by finding another like it on the piano. Now we will place the glass on a table, fill it nearly to the top with water, and hold the stem of it steady with the left hand. Then, if we moisten the second finger of the right hand with water, and rub itsteadily round the rim of the glass, we shall find before long that the surface of the water is in commotion, striking the sides of the glass and giving out a clear bell-like note.

HOW THE MUSICAL GLASSES ARE TOUCHED SO AS TO PRODUCE A MELODY

Long ago—some people think it was in the time of the ancient Egyptians, who used to make beautiful glass—someone found out that sweet notes could be obtained in this way from the rim of a glass vessel, and started experimenting. Thus the idea of playing musical glasses arose, and very beautiful music they give. For some 150 years people have enjoyed this music in Europe.

We can collect our own musical glasses; but we must make a diligent search for them, for not every glass has a true note any more than every person has a sweet voice. Ordinary drinking-glasses will do, but they must be thin. Two such glasses may be made just alike, but when they are tested, as described above, by tapping, with a thumb-nail or with the back of a knife, their pitch, or note, will be found quite different.

Suppose we want a glass which gives the note F, we shall possibly have to test a dozen or more glasses before we find one that gives a note anywhere near it. But even if it is not quite in tune, a little water poured into the glass will make the note lower, or lower the pitch. The reason for this is, the greater the number of vibrations per second, the higher is the pitch of the note. So we see that the water poured into the glass acts as a sort of brake on the vibrations, which have to move more slowly, and, in consequence, we get a lower note.

If we mean to have a complete set of glasses, we shall need about thirty-three, or just over two and a half chromatic octaves of tones and semitones. This makes a "manual," such as is seen in the picture, where it will be noticed that the glasses are of different forms and sizes, placed in order in wooden trays, with partitions to steady them. One advantage in playing on glasses is that we can place the notes of the scale in the order we prefer; and though we play with both hands at once, it is more convenient for a left-handed person to be able to place the notes most used under his left hand instead of under his right, as right-handed people have them.

Before attempting to touch the glasses we must be sure that the fingers are quite clean; and in order to harden their tips somewhat, and to improve our touch, we may dip them in a glass of water into which a few drops of lemon-juice have been poured. Then we gently and firmly rub the second finger of the right hand round the rims of the glasses in the same direction as the hands of a clock, and test all the glasses, going up the scale. At first the notes will come slowly, but with practice we shall get true, pure notes. Then we may try to pick out a tune. The Bluebells of Scotland or Home, Sweet Home, are found as easily as any. As both hands can play, while one is still touching a glass we can find the succeeding note with the other hand.

After a time players become expert in using both hands at once, so that they can employ them in unison or in part harmony. A skillful performer starts one note before the last one has died away, and so makes delightful harmonies.

Our musical glasses are very easily tuned, not that they really *need* tuning like a violin or a piano. All we have to do is to add a little water to the glass or else take some away from it, and so raise or lower the pitch.

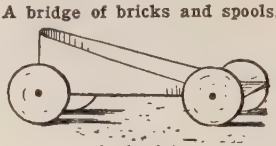
In the eighteenth century musical glasses were very popular, but sometimes the glasses were struck with wooden sticks instead of being rubbed with the fingers. These sticks were shaped like spoons and the bowls were covered with silk or cloth.

WHAT TO DO WITH SPOOLS AND BRICKS

IF we save all the empty thread spools and put them into the playbox, we can spend many happy hours playing with the spools and a box of toy bricks. When not in use, we can keep the spools threaded on a piece of string to prevent them from rolling into out-of-the-way corners. One of the most interesting things we shall be able to make is a little bridge to span a river.

First we must pick out ten fairly long spools to form the supports of the bridge. These spools we must soak in hot water to loosen the paper labels, which can then be scraped off. We place the spools on end in five couples at equal distances apart and join them up with long bricks, or a strip of card, cut the width of the two spools, which is long enough to span the river and rest on the banks. We can build up bricks to support the ends. The card can be nailed to the spools with tin tacks near the edges, and if we care to make parapets, two strips of card can be bent at right angles and the bent part glued down over the heads of the nails. This little bridge will be fairly substantial, and real water can pass under it, while over the top we can run a toy motor car or train.

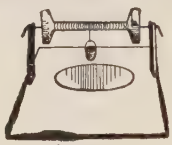
A bridge of bricks and spools.



A chariot.

The Parthenon made of spools.

Doll's table.



A well.

If we place four long empty spools on the table, two and two, on their sides, they suggest to us the possibility of making a pair of roller skates. A piece of thick wire must be bent round each end of the narrow central part of a reel, and a little sheet of tin, such as we can get from a preserved fruit or meat tin, should be shaped like the sole of a boot and attached in place by the wire coming up from the reels. Black tapes can be used for straps, and drawn under the tin near the wheels. A small glass dish, such as that in which potted meat is sometimes sold, might be tied on to the tin, filled with flowers and placed on the table, where it will make a novel flower-vase for pansies or other short-stalked flowers.

Another little toy, a miniature chariot, can be made with two long spools, as long as we can get, placed on their sides, one in front of the other. On the central part of the spool we lay a flat piece of wood from the box of bricks, or a piece of cardboard. This we can secure to the centre of the spools with twine. A sloped piece of card is then glued round the front of this, as shown in the picture. We can then make the chariot bright by covering it with silver paper. This serves as a very pretty holder for a glass of flowers. In a similar way a truck, such as railway porters use, can be made by leaving out the card at the front and adding parts of wooden skewers for handles.

To make the third toy shown in the picture take three long, narrow spools and place them one on top of the other in piles, arranged eight in a row in front, eight at some distance behind in line with the others, and the intervening space along each side filled with fifteen piles. What we are making is a model of the Parthenon at Athens. Having built up the columns, we place a row of bricks along the summits, place triangular pieces of card at each end to support two large pieces of card which will serve for the roof, and we have a rough copy of the Parthenon.

Another thing we can build with our spools is a tower, and for this we shall want plenty of long, narrow spools. After making a brick foundation, we place a dozen or more spools together in the form of a circle, and lay a disk of brown paper or card between each circle until seven tiers are built up, using fewer spools as we ascend. If we are skillful enough to place some of the disks a little on one side, we can imitate the tilt of the Leaning Tower of Pisa, shown on page 5721.

Other spools besides cotton spools may be available for making small toys. The spools on which wire is wound make nice wheels for a child's go-cart or mail-cart. The body of the cart is made of wire bent so that it makes the framework. This can be bent easily by the fingers. If a piece of white paper be pasted over one end of a short spool, we have a table for the doll's house.

We can make quite an elaborate toy in the following way. A wooden skewer, cut to a suitable size, is wedged into the central hole of a long spool, and is supported at the two ends in grooves of two upright pieces of wood which are glued to a piece of card with a circular hole in the middle. Two long, stout pins are hammered into the ends of this improvised wheel, and bent at right angles to form two handles used in winding and unwinding a thread rope, to which a little bucket is attached. A thimble, with a piece of wire encircling the rim and forming a handle, does nicely for this. Twine or coarse sewing-thread will do for the rope, which should now easily draw up bucketfuls of water out of a tumbler over which the little well-head may be placed.

The simplest toy that can be made with spools is called Spool Ring. A stout string is run through a number of spools and then the ends are tied together, forming a loop, or ring, on which the spools move freely. If this spool ring is spread out on the ground, a quick movement of a stick against its inner rim will send it a long distance.

THE RIGHT WAY TO CLEAN THINGS

THERE is a right way and a wrong way of doing everything. From time to time many things require cleaning; our clothes may become spotted with grease, our fountain-pen may get stopped up, or perhaps we may have been walking in the rain and so have been splashed with mud. When anything like this requires attention the best thing is to clean the article without delay. On this page we are told the right way of cleaning several things that are in everyday use, and if we follow the directions given we shall save both time and trouble.

TO CLEAN STAINED CLOTHES

Before being brushed with a clothes-brush, dusty or muddy garments should be well shaken out of doors. It is better to let splashes of mud dry on cloth, and then remove them with a hard brush, always brushing the way of the nap. To rub the splash with a piece of the material itself before applying the brush is a good plan. A grease-spot can sometimes be taken out of cloth or silk with a few drops of eau-de-Cologne or gasoline; and when grease is dried on cotton or woolen material, it may be removed by moistening it with warm water and soaping it. Benzene is also a good grease-remover.

Another method is to place a piece of blotting-paper or porous brown paper over the spot and press a hot iron on it, moving the paper every now and then until the grease is completely absorbed. Black cloth is freshened by sponging with cold tea or ammonia diluted with water. Lay the cloth flat on a table and sponge very carefully, moistening the sponge every now and then, and hang the cloth in the air to dry. Dirt-marks can be removed by rubbing them with rag dipped in gasoline, but this fluid must not be used near a light. Ink-spots can be removed by rubbing with milk or salt. This must be done at once, otherwise the application is of no use. If the ink-spots are old, the best method is to soap them and then lay a little salts of lemon or salts of sorrel on them; but the salts must not be rubbed in, or perhaps a hole may be made in the material.

TO CLEAN TOOLS

Every tool should have its place in the tool chest so that its edge is not blunted by knocking against other tools. Fine tools can be rolled up in flannel to keep them bright and free from rust. Any tool can be protected from rust by greasing it; but should rust attack it we must rub it off with emery-paper.

TO CLEAN KNIVES

We can clean a dirty, greasy knife by running the blade into mold slantwise several times and wiping it with newspaper. Table-knives are cleaned in a knife-machine, or by sprinkling emery-powder on a knife-board and rubbing the blade sideways horizontally along this so that the edge of the blade is not blunted.

TO CLEAN A FOUNTAIN-PEN

A fountain-pen is liable to get clogged with dried ink and hairs from the writing-paper and penwiper. If the pen has a movable point section, we can unscrew it, and let cold water from the faucet run through it. The pressure of the water is sufficiently strong to cleanse this part, even through a small opening. The barrel will stand a strong pressure of cold water. It is important to keep the rubber bulb and glass dropper rinsed out with cold water after "feeding" the pen, otherwise the ink dries in the bulb and spoils it. If our fountain-pen is a self-filling one, we can clean it properly by filling it with cold water several times and then emptying it.

TO CLEAN PAINT

Dirty painted wood should be first dusted with a dry cloth and then washed with a soaped one. Very hot water and a hard brush spoils the paint and takes it off. We must then rinse the surface with clean water and dry with a soft cloth.

We can remove paint from brushes by dipping them in linseed oil or turpentine, and washing them in soap and water in the palm of the hand. The soap must be rinsed out in fresh water, and the bristles shaped to a point before being stood upright to dry.

TO CLEAN DIRTY WET SHOES

If the shoes are very muddy, the mud can be wiped off with a damp cloth; cakes of it may be removed with a knife, but this needs skillful doing, lest the leather be accidentally cut. Wet shoes should not be dried before a fierce fire, for great heat impoverishes the leather. It is better to place them on their sides in a room or passage where there is a good draft. When dry, any remaining dirt can be brushed off before the shoes are blacked in the usual way for cleaning.

TO CLEAN A BICYCLE

When the bicycle is brought home wet and muddy, we should wipe the spokes and enameled parts with a cloth. Kerosene will clean the chain, and one of the numerous metal polishes will clean the nickeled parts. The chain may be brushed over with graphite or some preparation containing blacklead. Tires must be wiped clean with a wet flannel cloth. The best way to clean the bearings is to run kerosene through them until the dirt has been washed out, and then to apply lubricating oil.

TO CLEAN A SPONGE

Sponges are likely to become disagreeable and slimy if used long without being cleaned. This can be done by washing the sponge in ammonia and hot water, and then leaving it for some hours to soak in cold water in which some coarse salt has been dissolved. Soaking in sea-water, its native element, freshens up a sponge. A coarse cloth is better than a sponge for the bath.

TO CLEAN BOTTLES

A glass bottle can be cleaned inside in many different ways. One way is to pour some household ammonia into it, shake it well, empty it, and rinse it clean with warm water. If the neck be wide, small pieces of a raw potato mixed with salt and water can be shaken up in the bottle, or we may use tea-leaves.

MORE WOOD-BLOCK PRINTING

YOU were told how to make simple wood-block designs on page 617. This fascinating method of decoration may be extended to include more difficult designs which are suitable for different purposes. As was pointed out, this art is not new. It was used early by the peoples of several countries because of its many possibilities for expressing ideas and for experimenting with pleasing effects.

The Egyptians are said to have used the Oriental art of wood-block printing several thousand years before Christ. The Chinese are known to have printed their books by this method as soon as paper was invented. The Hawaiians also stamped cloth with rude implements, while the East Indians decorated their dyed fabrics by means of simple blocks. Then Dürer, in Germany, developed the art in wood and copper plate. During the eighteenth century the Japanese began developing block printing as an art, even making it represent their national life. At first only black and white were used, the color then being added by hand.

Next glue some felt to a piece of glass and you have a pad on which to charge the block. Saturate the pad with thick water color or ink, to which mucilage may be added. Use a padded drawing-board and any paper that will take water color well, and you are then ready for the fun of block printing. It is done by charging the block on the ink-pad and pressing it to the paper or cloth to be printed somewhat as post-office clerks stamp letters. When the block does not print well the trouble may be that the design is not cut deep enough, that the paint is too thin, or that more pressure is needed in stamping. It is interesting, after securing a good print, to make some experiments, such as stamping on dampened paper or cloth. The latter is satisfactory, for it absorbs paint well, but after drying it must be pressed to remove the wrinkles. Another experiment is to stamp the design in ink and, when it is dry, fill in with strong colors. Oil paints (mixed with turpentine) may be used by applying with a bristle brush directly to the wood-block. Sometimes several

WOOD-BLOCK PRINTING ON TEXTILES

Later came the discovery of printing colors with a second block, and finally the number of blocks was increased. As a result their printing became well known all over the world, but modern commercialism as well as lack of masters later caused its decline.

For the printing-block you may have discovered why you should be careful to choose soft wood, which is close-grained and without knots, such as gumwood, pine, boxwood or holly. The size is optional, but should be at least ¾ inch thick and 1 inch square, as a block smaller than this is not easily managed. Next make simple designs on paper of the desired size, using black and white masses with few details. You should visualize the effect that will result when repeated in the pattern. Now make a tracing on Japanese paper with brush and ink to insure clearly defined shapes, and paste this face downward on the block. Incise the outline of the design with a knife to the depth of about ⅛ inch, and remove the background with a gouge or chisel. Then remove the remaining design paper and the block is ready to be used.

blocks are made for the same design, each block stamping a different tone, as is done in printing landscapes on soft rice-paper.

Only the more experienced should attempt picture-printing with many blocks, as it necessitates overlapping transparent colors to produce good effects. As previously pointed out, simple problems, such as the decoration of notebook covers, posters, calendars, programmes and pillow designs, are better for the beginner, while stamping curtains may serve as a later problem. Crash, cotton crêpe, coarse denim, monk's cloth, art cheesecloth, scrim, grass linen, pongee and silk may be used successfully for this purpose, but it should be remembered that a smooth glazed surface does not receive the print well. Three examples of wood-block printing on textiles are shown above. In washing any of these materials, lukewarm water and pure soap are necessary, as is also quick drying. Oil colors wash well, but dyes are not so reliable. Water color mixed with mucilage must be pressed before washing. Fading sometimes occurs, but it is not always a disadvantage. It softens colors, making them more beautiful.

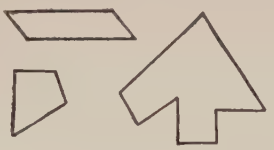
THE ANSWER TO THE CHARACTER GAME

On page 5205 are descriptions of well-known people mentioned in this book. The men and women referred to are: 1. St. Francis of Assisi; 2. Oliver Cromwell; 3. Shylock; 4. Joan of Arc; 5. Florence Nightingale; 6. David. These are people who should be known to us all.

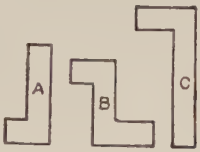
PUZZLES WITH PAPER AND SCISSORS

THERE are many curious ways in which boards or cards of one shape may be cut up into a comparatively small number of pieces, and the pieces rearranged so as to form an entirely different shape.

For instance, a carpenter had to mend a hole in a cupboard door, the hole measuring 6 feet by 1 foot, and all the wood he had for the purpose was one piece measuring 4 feet by 18 inches. His employer told him that this piece could be cut into two pieces and put together so as to exactly fill the space without any overlapping. The carpenter was greatly puzzled at first, but after measuring the wood, and carefully considering, he took his saw and sawed it into two pieces which, when put together, filled the hole exactly. How did he divide the wood? We should cut out of paper the shape of the piece of wood the carpenter had, counting inches for feet, and see if we can do with it what he did.

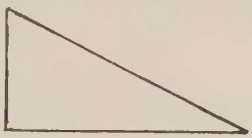


1. Pieces to form an octagon.



2. To make a cross.

3. The puzzle cross.



4. The triangle puzzle.

Another carpenter was given a plank of wood measuring 15 feet long by 3 feet wide, and with this he was told to put down a floor in a cupboard which was exactly square, but he was on no account to cut the plank into more than five pieces, four of which were to be equal in size. He thought for a few minutes and then cut the plank as instructed, and the five pieces of wood exactly covered the square cupboard floor. Let us cut out a piece of paper like the plank, reckoning inches for feet, and see if we can cut it as the carpenter did, into five pieces that will form an exact square.

There are many other puzzles of this kind that will afford a great deal of amusement and will exercise our skill and ingenuity. If we take a sheet of paper and cut out from it four of each of the three shapes given in picture 1, we can fit these twelve pieces together so as to form an octagon, or eight-sided figure. We can easily trace the shapes from this page, and then cut them out of stiff paper or cardboard as suggested.

Another interesting puzzle of this kind is to cut out eight squares, then to take four of them and divide each of these into two equal triangles by cutting across from corner to corner. We now have four squares and eight triangles—twelve pieces in all. Now let us fit these pieces together so as to form a perfect square. It is very easy to do when you know the way, but it requires thought and skill.

Here is another puzzle of a similar kind. Cut out three pieces of rather stiff paper of the shape of *A* in picture 2, and one piece each of *B* and *C*. Now put these together to form a cross.

Still more ingenious is this puzzle. The cross with candles in picture 3 is made up of nine pieces, as can be seen. Take a piece of paper, oblong in shape, say, 4 inches by 2½ inches in size, and fold it in such a way that with one cut of the scissors you divide the sheet into the nine pieces that will form a cross and candles like those shown in the picture. It can be done quite easily.

Another interesting puzzle is to cut out in paper or card twenty triangles, the shape of the one in picture 4, and to arrange the twenty triangles so that they will form a square.

Some curious results may be obtained by drawing triangles. Here is an example. Cut out of a piece of paper an equilateral triangle, that is, a triangle that has all its sides equal. Now let us draw upon the triangle thirty straight lines in such a way that we make the greatest possible number of triangles. What is the largest number that we can make?

The solutions to all these very interesting puzzles will be found on page 5514.

A POPGUN MADE FROM A QUILL

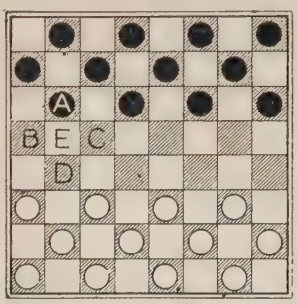
A QUILL popgun is an amusing little toy that any boy can make without expense. All that is needed is a good quill of fair size that we can make from a goose-feather by pushing out the pith. We cut the quill evenly at each end, and make it about 3 inches long.

Now we take a raw potato and cut it into slices about ¼ inch thick, or a little more. We push one end of the quill through one of the slices of potato, and this will cause a piece of potato to stick in the end of the quill. Then we push the other end of the quill through a slice of potato, thereby getting a piece of potato at that end also. Now we make a piece of wood as shown in the picture. This is to act as the rammer. The thin part should be almost the size of the quill, and the thick end is to prevent it from going too far through the quill. Then, by pushing this rammer into one end of the quill, we can fire our popgun, which we can load as often as we wish by pushing the empty end into a slice of potato.

HOW TO PLAY CHECKERS

THE ordinary game of checkers, unlike most amusements, is so simple that a child can learn to play it, and yet it lends itself to such careful study that men play it almost as they play chess, looking many moves ahead, and making the most wonderful combinations.

The board has 64 squares, 32 of one color, as, for example, white, and 32 of another color, such as black. There are 24 men, disks of wood or bone, 12 white and 12 black. Each player takes one of the sets of men and arranges them as in the first picture, taking care that there is a white square at the bottom right-hand corner of the board before him.

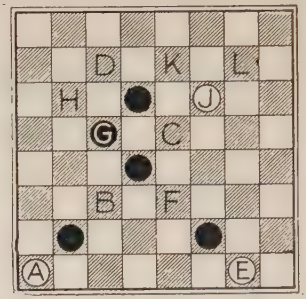


The pieces are placed on the black squares to start with and are always played on these squares, never being moved on to the white. They are moved diagonally—the man A in the first picture will move to B or C, but will not leap across the white square E to D. They move forward, one square at a time, the players taking turns alternately. A man is captured by the opponent's piece leaping over him diagonally into a vacant square beyond, and the captured man is then removed from the board.

If, after leaping across an opponent's man into the next square beyond, we come next to another of our opponent's pieces with a vacant square beyond that, in either direction, we can continue our move and leap over this second piece, taking that as well as the first one. Even more men can be captured at a single move, provided each one has behind him a vacant square into which our piece can be moved.

The second picture, which is a game in course of being played, will explain the moves clearly. We can move from A to B, then to C and then to D at one move, taking three of the black pieces on the way. But from E we could move only to F; we could not go to G because it is occupied by a black piece, and we cannot leap across two pieces together and go to H. When we are not capturing the men, we move only to the next square. The white man J, in the second picture, can move only to K or L.

As soon as a man has reached one of the four squares at the opposite end of the board he is crowned; that is, has another checker put on top of him, and becomes a king. He can now move either backward or forward on the board. This is a great advantage, and sometimes five or six men may be captured by a king at one move. The object of the game is to take all our opponent's men, or so block them up that they cannot move; then we have won.



When an opponent is able to take one of our men, and does not do so, we can either huff him—that is, take from the board the man with which he could have captured our piece—or we can compel him to make this move in preference to the one he has taken. Huffing does not count as our move. The choice of color is decided by lot, and black moves first. In each fresh game we change our men, playing first with black and then with white, and so on. If we touch a man, we must move that man. If we remove one of our own men from the board by mistake, we have to lose it. Usually when only two kings remain on the board a deadlock occurs, and there is no way of either player winning, except by the gross carelessness of the other; therefore, with only two kings on the board, the game is drawn.

HUNTING THE FOX AND THE GEESE

THERE is an interesting and exciting game that can be played with checkers on a checker-board, which is usually called Fox and Geese, but is much better named Fox and Hounds. It is a game of skill for two players; and five checkers are used in the game, one black, called the fox, and four white, called the geese, or hounds.

To begin the game the players choose sides, one being the fox, and he takes the black checker; while the other, who plays hounds, takes the four white checkers. The hounds are arranged on the four black squares at one side of the board, while the fox is placed on any one of the four black squares at the opposite side of the board.

The game is for one player to make his hounds hem in the fox, while the aim of the fox is to escape through the line of hounds to the far side of the board, which means a win for the fox. The moves are made as in an ordinary game of checkers—that is, diagonally, one square at a time; but while the hounds may move only in one direction—forward—the fox is allowed to move either backward or forward, like the kings in ordinary checkers.

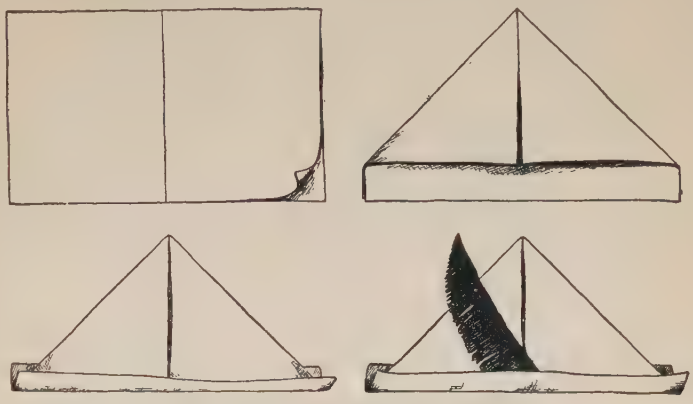
Given two equally skillful players who know all the moves, the hounds are sure to hem in the fox; but unless the players are thoroughly well up in the game, there is an exciting contest, in which sometimes the fox, and sometimes the hounds, will win. Of course no pieces are taken in the game, and the hounds always have the first move.

When we play as the hounds, the great idea is for us to keep our pieces in a line and gradually move them forward in this way; whereas, if we are the fox, we should move our piece about in such a way as to confuse our opponent and make him get his men out of a straight line. The slightest slip in the moves of the hounds will let the fox through.

MAKE YOUR OWN SOLDIER'S UNIFORM

ALL boys like to play soldier from time to time. But it is no easy matter to be a soldier without some kind of a uniform to wear. If you haven't a real soldier suit, you may easily make the following uniform at little cost. This outfit consists of a hat, a shield, the epaulets and a play sword.

For making the soldier's hat the diagram shows the detailed steps in its construction. This is made from any tough, colored paper of medium weight, such as book-cover paper. If this is not available, heavy wrapping-paper may be used. In any case a piece of paper about 14 inches by 20 is needed for the soldier hat. First fold the two narrower edges together until they touch. Then crease the paper through the centre. With the paper still folded, make a second fold as shown. This line forms a guide line for the next two folds, which make the point of the hat. Now place the papers, while open, on the table, with the folded edge at the back. Then carefully fold each half of the back edge down along the line made by the last folding. Next fold up and crease the lower open edges forming the rim of the hat. The rim should be pasted down to make the hat firm and strong. If desired, a feather may be used. A real feather may be secured, or one may be made by fringing strips of red or blue crêpe paper and twisting them round a narrow strip of cardboard which is fastened inside of the rim of the hat.



Steps in the making of a soldier's hat.

In making the shield first draw a suitable pattern. If you prefer, you may copy one and enlarge it until it is the right size. Then draw it on heavy white cardboard, and cut it out. A good size for the shield would be 8 or 10 inches by 10 or 12 inches. After it is cut it can be decorated with colored pencils or paints, or with colored paper. The stripes are drawn carefully with any straight edge and filled in with color, one red and one white. The blue ground above the stripes might well be dotted with stars which are cut from gilt paper and pasted. Two holes are next punched in the sides of the shield, and a bit of string is strung in, by means of which the shield may be hung round the neck.

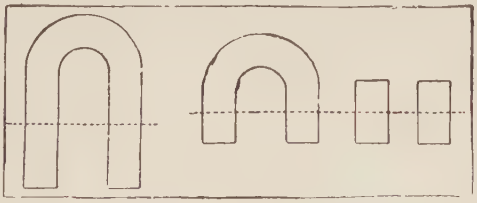
The sword for this home-made soldier suit is made by rolling a narrow piece of paper. First cut some narrow strips of the book-cover paper and join them with paste until there is a long strip. Roll this strip of paper well until it is about 15 inches long, and then press it flat between heavy weights. Roll a second strip of paper for a length of about 6 inches and fasten it to the broad end of the sword as its handle.

The soldier's epaulets are just 5-inch by 2-inch strips of this book-cover paper which has been cut to fit the shoulders. These may be decorated with fringed tissue-paper before they are pinned to the soldier's coat shoulders with safety-pins. This gives an ordinary play suit quite a military appearance.

Tinfoil may be pressed over buttons of an ordinary coat to add the last touch.

SOLUTION OF THE CARD PROBLEM ON PAGE 5202

THE boys and girls had been greatly puzzled for a long time by the problem that their uncle had set them, but when he showed how the horseshoe card could be divided into no fewer than seven pieces by making only two cuts, it seemed very simple indeed. The card was not to be folded in any way. Holding the card at the bend in one hand, the uncle took the scissors in the other and made one cut across the two arms of the card. This, of course, divided the card into three pieces. Then putting the two straight pieces which he had cut off by the side of the piece of the card that was left, and that was still a horseshoe shape, he made one cut right across, cutting through the two pieces already detached, and also through the two shortened arms of the horseshoe. This divided the card into seven pieces, as was desired, and the problem was therefore solved in the manner shown in the above picture.



How the two cuts are made in the horseshoe card.

THE NEXT THINGS TO MAKE AND TO DO ARE ON PAGE 5507.

BUILDINGS OF OLD GREECE AND ROME

A reconstruction of the Appian Way, by which Paul walked to Rome.

Poseidon's Temple at Pæstum as it was.

The Temple of Jupiter at Pompeii.

The buildings at Olympia as they appeared in the great days of Greece.

The old Roman amphitheatre at Verona.

THE GREEK AND ROMAN BUILDERS

WE know from our chapters on sculpture how this small people, the Greeks, in an insignificant country, and within the short span of a few hundred years, stamped the world unalterably with their forms of beauty. And in architecture, as in sculpture and letters, they were destined to a unique place. It would seem as if some god had shaped them, as King Arthur modeled his order of the Round Table:

> A glorious company, the flower of men,
> To serve as model for the mighty world
> And be the fair beginning of a time.

It is over two thousand years since these masters of art set up their buildings, and they are still the model for a world which has passed through changes and developments inconceivable to them.

Now, we can all judge paintings and we can all judge statuary. Judgment of architecture is not so easy, because, to use a homely saying, there is more in it than meets the eye. And a great many people are uncertain about Greek architecture. They want to know why it is so wonderful. It is wonderful because it is not only inspired by a sense of beauty, but it is reasonable, logical and sane.

A building, large or small, is put up in order to roof in a certain space. If it is a good building it must give the impression of having been thought out as a whole, and not just put together, hall on hall, chamber on chamber, and a back entrance and front entrance added.

In reviewing the architecture of the Greeks we are bound to speak of their temples and occasional monuments only; their private dwellings and such palaces as they had have not survived the tragedies of their later history. We can only surmise what they were like from the houses of Pompeii and Herculaneum, which were built under Greek influence.

The keynote of their temple architecture is its simplicity. The building was a rectangle, plain and severe, with a gable at each end. Except for sculptural decorations—which were kept within the inclosing rectangular shape—the only "trimmings" were rows of columns. And the genius of this restrained classic architecture lies in its perfection of proportion. Its proportion is so perfect to the smallest detail that if a man studies and memorizes the construction of a temple front, it is as if he had learned the grammar of a language.

Proportion in architecture is a technical and very wide subject. It means, among a great many other things, that

the mass of a building must not be too long for its width, or too tall for its breadth. It means that vertical and horizontal lines must not make too broad a shape or too narrow; that a line must be stopped properly and not just end; that a column must not look too thin to carry the weight on it, or so thick that it appears clumsy and out of place: "a column with a building added."

The Beauty of a Building with Its Perfect Proportions

We may never have time to study properly the laws of proportion, but we can remember this: perfect proportion reaches out to where calculated skill ends and beauty begins. Or, to put it another way, a building perfectly proportioned is in itself beautiful, no matter of what material or color, or how plain it is—it delights the eye.

Greek architecture was characterized from the first by the use of columns and by its square, not arched, openings. The genius of its builders was spent in carrying this style to its utmost finish. In so doing they took what seemed to them good of other countries' work and refined it to their own use. They left behind the gorgeous splendor of the Assyrians and the secretiveness of the Egyptians. Their ideas of suitability were reasonable and sane. They did not want to build temples like those on the banks of the Nile, inclosed in a mighty blank wall, with all their beauty concentrated in the dim, mysterious pillared hall where only the privileged might enter. The Greek temples were for the Greek people: they were open to the sun and air, and looked happiest when men and women were passing to and fro.

The Fine Marble the Greeks Used for Their Buildings

The Greeks were fortunate in possessing an unlimited supply of the finest marble. Nearly all their buildings, and all their most important buildings, were constructed of this very delicate and exacting material. It was partly because they worked in marble that their construction was so perfect in detail and had such a smooth and fine effect. There is a natural clumsiness in stone that hides small defects in treatment, but marble hides nothing. So that the beauty of the Greek work was the beauty of accuracy, the beauty of a musical note struck exactly in the middle.

These people lived in a land of clear air, brilliant suns and sudden, short rains. It was essentially an out-of-door life, and it is probably because of this that no great municipal buildings were erected. Politics and philosophy were discussed out in the town, dramas played, poetry recited, tales told, in the open air. It has been suggested that this is one of the reasons why all the temples have open, pillared porticoes where people could take refuge from the shower. In any case, the Greeks loved the effect of drifting sun and shadow falling rhythmically across the columns of their temples. The greater buildings had columns all around; all of them had columns front and rear. Inside the ranks of this beautiful guard was the sacred building, enshrining the chamber where stood the statue of the god or goddess.

The temples were set in a kind of sacred inclosure, in the most effective place, generally the acropolis—the hill of the town or upper city. Sometimes when we see a drawing showing a reconstruction of the Parthenon as it was in Pericles' time, it seems to us rather a severe building, standing alone on its three-stepped platform, or *stylobate*. We should try to see it in the mind's eye—a dazzling mass of marble, crowning a hill above a sapphire sea, with flying clouds, and movement, and life about it.

The Three Kinds of Columns on Which Greek Temples Were Based

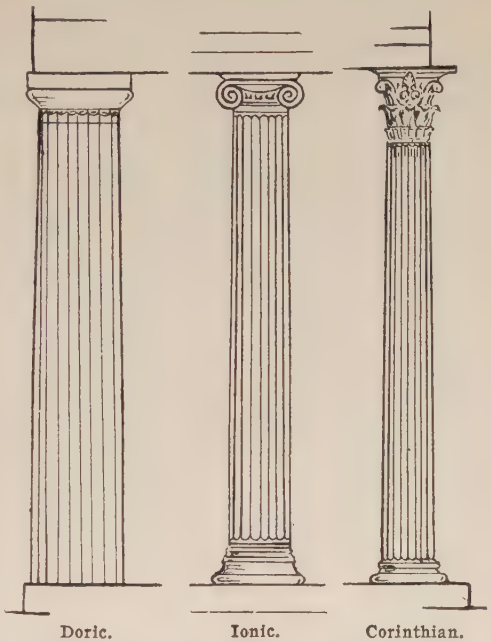
Just before the time of Jesus Christ a learned Roman architect named Vitruvius wrote a book on Greek architecture, and he classified it according to the different kinds of columns and the *entablature*, or the horizontal portion supported by the columns. This fragment of architectural design he called an Order, because its parts were framed according to a strict rule and order, and not put together by chance.

The "label" has been used ever since, and so we have the Doric Order, the Ionic Order, the Corinthian Order, so named from the three columnar designs on one of which all Greek temples were based. The Romans added two more, the Tuscan and the Composite.

These five Orders have been for almost two thousand years a kind of Bible to students of architecture. By far the most important is the Doric; then comes the Ionic; the Corinthian was evolved when Greece was under Roman rule, and can therefore scarcely be classed with the other two, which are pure Greek.

The Doric column is said to be the most perfect detail of architecture ever evolved, and depends for its beauty on its extreme simplicity and the genius of its proportions. It might sound rather childish to say that the chief thing about a column is that it must stop somewhere and somehow; but it is nevertheless true. There are millions of columns in the world, and we can scarcely pass through a city without seeing many kinds. And as we are busy with our own work, it has probably never occurred to us that a column is ugly or beautiful according to the proportion of thickness to length, to its base, and the manner in which it is connected with the part of the building resting on it.

The Doric column has no base; it stands directly on the steps of the temple, as we can see in the photographs of the Parthenon and the Theseum, at Athens. As it has no base, it cannot have too elaborate a capital. The shaft of the column is in a definite proportion to its height, and it tapers as it rises. We can easily see it grow in imagination, or for that matter we can carve one for ourselves. A square column has its corners shaved off; it is now eight-sided; again its corners are shaved off; it is now sixteen-sided. These sixteen planes are hollowed out—"fluted"—and there is the Doric shaft. Sometimes it had sixteen, but the general number of flutes was twenty.



THE COLUMNS IN GREEK ARCHITECTURE

Although the base of the column stands directly on the ground, the top cannot rest directly under the *architrave*—the plain, horizontal block of marble that comes next to the column—because it looks ugly. And anything that looks ugly is wrong. The fluted shaft needs to be connected in some way with the architrave.

First, near the neck of the shaft comes a single horizontal line, a warning that the long vertical lines of the flutes are about to end. Then the neck itself is grooved by a number of horizontal lines. Over it the *echidnus* broadens out as a support for the *abacus,* which in turn supports the architrave. One of the chief beauties of this famous Order lies in the skillful way in which the horizontal and vertical lines play against each other.

When we look at a photograph of the Parthenon we notice that the architrave is a long line of plain marble, but we do not always see that this undecorated, ungrooved stretch is one of the beauties of the Parthenon. It has a double value. It is a horizontal mass occurring immediately above the vertical mass of the columns and immediately below the vertical lines of the *triglyphs* that form part of the frieze. Also, as we have said, it is a plain mass set between two decorated masses—the grooved columns and triglyphs, and the sculpture of the *metopes.* Triglyphs and metopes alternating make the frieze — an endless repeat of three vertical bands and a square relief. On these triglyphs rests the weight of the roof.

There are no traces of windows in the Greek temples with which we are familiar. It is supposed that enough light came in through the open doorway. And this we can understand, as the light in that sunny land has such a brilliant quality.

The Doric Order was the earliest evolved in Greece, and most of the temples of her great years are built in this style. The Theseum, the temple of Theseus, is in the best state of preservation, but its columns are not so beautiful as those of the Parthenon. At Olympia there was the temple of Zeus, and at Ægina the temple of Aphaia. All these were built in the fifth century. The Parthenon is the greatest, as we have said on page 4221.

The Ionic Order was built up on the same principle as the Doric, but its proportions were different; it was less massive, less severe, more ornamental. The length of the Doric shaft was about five times the diameter of its base. That of the Ionic was about nine times the diameter of its base. The Ionic shaft was fluted, like the Doric, but the sharp edges between the flutings were planed down. The Doric shaft rested on the stylobate, or uppermost step; the Ionic had a molded base, generally of three layers. Instead of the plain, massive capital of the Doric, the Ionic had a scroll-shaped capital, its lines not unlike the spiral curls of the nautilus shell. It is this capital which is the chief distinguishing mark of the Ionic Order.

In all their work the Greeks were careful to leave the architrave plain; or, if a line were inserted, it was a horizontal line, thus strengthening the unbroken horizontal effect. In the Ionic Order the frieze ran continuously above the architrave, and was not broken up into triglyphs and metopes like the Doric frieze.

THE LITTLE IONIC TEMPLE NO BIGGER THAN A HOUSE

One of the most exquisite little temples in the world—that of the Wingless Victory on the Acropolis at Athens—was built in the Ionic style. You can see it in the right foreground of the top picture on page 705. For some reason it pleased the architect Callicrates to make this temple just about as big as a house. The lovely little frieze which ran round it, above the Ionic columns, is in the British Museum, in London. The temple, as it stands, was reconstructed from the ruins left by the Turks about the middle of last century.

A much larger Ionic temple was the Erechtheum, also on the Acropolis, and it shares with the Temple of Diana at Ephesus the honor of being the greatest Ionic buildings set up by Greek architects. In planning the Erechtheum the architect Mnesicles departed from the usual Greek idea of a severe rectangular edifice, and threw the shrines of three different temples together, each abutting on the other, with no symmetry in the whole. At the south side is the famous Caryatid portico, of which we show you a picture on page 1068. At the north is another portico of very elaborate Ionic columns. A great deal of extra carving was done on them. Among other things on the abacus was the "egg-and-tongue" ornament so familiar to students in art schools.

In a great many of their temples the Greeks applied color to their pillars and gold and color to throw up the figures on the friezes. This effect was gained in the Erechtheum by the use of black marble as the groundwork of the frieze. The sculptured figures in white marble were attached to the black background by metal clamps. We can imagine how gorgeously beautiful and effective the finished building was.

HOW THE TURKS SPOILED THE BEAUTIFUL TEMPLES OF ATHENS

It is one of the world's tragedies that most of this Greek architecture should be in partial ruin, or in a state of reconstruction. Lovers of art find it difficult to forgive the Turks their barbaric treatment of Athenian temples during the time of their occupation. They turned the Erechtheum into the women's quarters of a great household. Other troubles came on the temple, and at last Nature herself brought ruin through a great storm, in 1852, which threw down a good part of the re-erected building.

A similar tale attends that marvelous pile so rightly called by the ancients one of the wonders of the world—the Temple of Diana at Ephesus, in Asia Minor. You may find a picture of this on page 2608. It stood on the site of an archaic building—fragments of whose columns are in the British Museum—which was burned down the night Alexander the Great was born, in 356 B.C. The "new" temple was built during Alexander's reign by Democrates, the architect, with Scopas, as master sculptor, supervising the work of a large number of artists.

This Temple of Diana was the centre of a great part of the national life of that province of Asia. It was more than a building: it was a living institution. Like the medieval monasteries of England, it owned land and had a large income. All the festivals of the district were held there, and a great army of priests and what the Bible calls soothsayers were attached to the temple. Public funds were housed in the precincts. In fact, to have uprooted the Temple of Diana during the first three hundred years after its erection, would have been to tear out the heart of Ephesus.

DEMETRIUS, THE SILVERSMITH, CRIES OUT AGAINST PAUL

A very rich trade of making silver images and shrines of Diana—much like that of the Christian craftsmen of early Europe—was carried on, as we know from the Acts of the Apostles. These images, together with the temple itself, were denounced by Paul and his followers, and this was the occasion of a great outcry.

"Sirs," cried out Demetrius, the silversmith, "ye know that by this craft we have our wealth. . . . Not alone at Ephesus, but almost throughout all Asia this Paul hath persuaded and turned away much people, saying that they be no gods which are made with hands . . . so that the temple of the great goddess Diana should be despised, and her magnificence should be destroyed, whom all Asia and the world worshipeth." And when they heard these sayings they were full of wrath and cried out, "Great is Diana of the Ephesians!" And the whole city was filled with confusion. . . . All with one voice for about the space of two hours cried out "Great is Diana of the Ephesians!"

Pliny, the Roman historian, wrote a description of the temple, and from that information architects have been able to reconstruct it. There is no doubt that on the temple a great wealth of art was spent. The ranked Ionic columns had wonderful sculpture running round their bases and the lower parts of the shafts. The *pediment*—the triangular piece of wall between the cornice and the roof of the temple front—was a mass of magnificent carving, showing Diana on her throne, with princes and horses, lions and rams, on either hand, in a procession of honor.

THE BREAKING-UP OF THE GREAT TEMPLE OF DIANA

Toward the middle of the third century after Christ the temple was mutilated by the Goths, and about a hundred years later it was denounced and closed altogether at the order of the Christian Church. It then became a kind of quarry whence the best marbles were hewed out to help to build the churches of the "new" religion. A great deal of it went into the Cathedral of St. John at Ephesus; eight of its dark green marble columns are in the Church of St. Sophia, Constantinople. The rest of the temple ruins became slowly buried under the dust and débris of succeeding centuries, and lay at peace there, forgotten by spoilers. In 1869 an English architect, Wood, began a course of excavations, and took fragments back to England. These are now with the fragments of the earlier archaic temple in the British Museum.

There is a pretty story told by Vitruvius about a Corinthian bronze-worker called Callimachus. One day this man saw on a girl's grave a basket with acanthus leaves curling up around it. A square, flat stone, or tile, lay on the basket. The general shape took his fancy, and from the idea he fashioned in bronze the capital of a small column, in shape like an inverted bell, sheathed with acanthus leaves.

This is said to be the origin of the Corinthian Order, with which we are probably more familiar than with either the Ionic or the Doric, because it has so often been used, and is used to-day, in design and in ornaments, like candlesticks, and in monumental stones for graves, and in woodwork, and in so-called classical architecture.

THE TOWER BUILT FOR WATCHING THE PASSAGE OF THE SUN

The Corinthian Order, as we have said, was used by the Greeks less than were the other two Orders. The shafts have a molded base, much like the Ionic, and the Corinthian also largely resembles the Ionic Order in the way the columns support the roof.

Not many large buildings were planned in this Order, but there are several smaller temples, buildings and monuments, like the Temple of Apollo at Miletus, the famous Choragic Monument of Lysicrates, at Athens, and the Tower of the Winds, built for observing the passage of the sun and for recording time, also at Athens.

The Choragic Monument, which was typical of a great many in the Street of the Tripods, was a circular structure built on a deep square base, and measuring, in all, a height of some thirty-four feet. Six Corinthian columns, eleven feet high, stood round the body of the monument. Above them was a marble dome crowned by an ornament framed to hold the tripod. This was a prize given to the winner in certain games, and was fashioned on the original Tripod, a peculiar seat where the Delphic priestesses sat when they pronounced their oracles and "inspired" sayings.

THE OLD GREEK TOMB WHICH IS NOW IN THE BRITISH MUSEUM

The Greeks, no less than the Egyptians, honored their dead and made tombs for them, though not by any means on a stupendous scale. One of the earliest,

built at Xanthos about 550 B. C., the Harpy Tomb, is now in the British Museum; and there also is a model of the Nereid Monument. This was a little building, also from Xanthos, surrounded by Ionic columns, built about two hundred years later than the Harpy Tomb.

We read of the Mausoleum on page 4332. On page 4466 are pictures of the lovely tomb of The Weepers and the Alexander Sarcophagus, both in the Constantinople Museum. These are the most important, and are monuments of beauty. But on all their tombs, whereof numerous fragments remain, the Greek architects and sculptors expended a very fine and finished art.

THE OPEN-AIR THEATRE WHICH HELD THIRTY THOUSAND PEOPLE

Their most important erections, next to the temples, were the huge open-air theatres, many of which still exist, though in a ruined state. They were built outside the town in a hollowed space or in a natural rocky basin. The germ, or kernel, of the theatre was the circular orchestra; two-thirds of the way round it rose tier upon tier of seats, invariably cut out of the solid rock in blocks. Behind the orchestra, on a kind of platform, stood the stage, built of stone, forming a permanent background to the play.

The principal theatre of Greece, the theatre of Dionysus at Athens, was an enormous place, capable of holding thirty thousand people. That at Epidaurus, not so big, was more beautifully planned. It was built by Polyclitus about 350 B.C., and is in a wonderful state of preservation.

The Greeks had buildings for athletic contests, stadia and hippodromes for races, and gymnasia for exercise, bathing and amusement.

Greek architecture was a one-storied architecture, had no towers, no arches, no upward fling from the body of the building. It had no mystery, no thrill of the half-lights of Egyptian temples. It was not a stupendous, awe-inspiring architecture. There are many ordinary churches in North America bigger than the Parthenon. Its beauty was the beauty of logical thought, which showed in its simplicity and proportion, and the beauty of an exquisite finish and perfection of detail.

ROMAN ARCHITECTURE BORROWED FROM BOTH GREEK AND ETRUSCAN

The Romans were the inheritors of Greek civilization abroad and Etruscan at home, and they took what seemed to them best from both styles of architecture. From the Etruscans they took the art of massive wall building, the construction of the arch and the dome—which the Etruscans in turn had inherited from the East—and developed them in their characteristically powerful fashion. From the Greeks they took their columns and square openings.

The Greek style suffered at the hands of the Romans. It would seem that the barbaric strength of the Etruscan work secretly pleased them, but they had a great admiration for Greek art, and in many cases when they had planned a building on the Etruscan style, they proceeded to decorate it in the Greek style.

They made strong arches, and then on the piers of the arches put a surface column which supported the entablature—the horizontal portion—above the rounded shape of the arch. So that inside was the arch of the Etruscans, the real strength of the structure, and outside, adorning it, lay the vertical and horizontal decoration of the Greek columnar openings.

We can see this at a glance if we look at the picture of the Colosseum at Rome. As the Greek columns had been designed for strength to support the roof, and always ran the height of the building, it was perhaps bad art and quite unnecessary to use them as facings for one story only. But the idea grew and became a distinct style, reappearing in European architecture centuries later.

THE ENDURING STRENGTH OF THE AQUEDUCTS THE ROMANS BUILT

When the Romans were simply building for strength and enduring qualities, and not trying to be artistic, as in their famous aqueducts, they did not trouble to add the Greek columns and architraves, and they built something extremely beautiful and dignified, and never to be forgotten. The aqueduct known as the Pont du Gard at Nîmes, in France, is one of the finest things in the world, infinitely more beautiful than the Colosseum. We cannot understand how they could look at it, or the Aqua Claudia, at Rome, and not see that they had achieved a singular greatness. Whereas it would seem that they said to themselves: "We must have aqueducts, because a town without a good water supply is no town. We must have bridges, because an empire without unbroken highroads is no empire. Let these

be made plain and unadorned; we merely ask that they shall last forever. And *then* we will have some really beautiful buildings."

But not all their buildings were planned in a combination of arch and square, columnar openings. Some of their temples and basilicas, or public halls, had many columns supporting the roof or portico openings, and might be described as Roman-Greek, a style wherein the Greek was curiously spoiled and vulgarized by a people who lacked the exquisite Grecian taste. Generally speaking, the Romans were more showy, more ornate. Only one thing did they simplify, and that was the Doric column. To their variation of this Order has been given the name of Tuscan. The other of the two Orders evolved by them was the Composite, whose capital was a mixture of the Corinthian and the Ionic without the pure grace of either.

WHY THE ROMAN ARCHITECTURE DIFFERED FROM THE GREEK

There were two chief reasons for the distinctive style which Roman architecture developed as the empire grew. One was the material to hand, and the other the fullness and complexity of their life. Because of this it was inevitable that their work should fall away in an ever diverging line from the Greek style they admired. Greek architecture, produced by a company of artists, was an architecture of religion; that of the Romans, produced by a race of builders, was the architecture of a great and ever widening empire. The one was centred on the Acropolis, the other in the Forum, or market place, where men gathered to buy and sell, to discuss politics, to learn news. Round the Forum the chief buildings of Rome were grouped, and when the mighty city was in her glory they must have been an imposing sight.

Roman architecture included enormous walls, bridges, aqueducts engineering feats; it covered a great diversity of buildings—temples, tombs, basilicas, or public halls, palaces, baths, circuses, theatres and amphitheatres.

THE PILLARS AND ARCHES THE ROMANS BUILT FOR GLORY'S SAKE

There were smaller architectural works, like triumphal arches, pillars of victory, and fountains. The arches and pillars they built for glory's sake, to commemorate the greatness of their emperors and generals. In Rome there were the Arches of Titus, Constantine, Septimius Severus; at Ancona the Arch of Trajan, and another at Beneventum, in southern Italy. The arches were either single or triple, adorned with sculptured reliefs; their piers faced with Corinthian or Composite columns. The Marble Arch, London, is of the triple-arch kind, built in imitation of the Roman.

Of the Pillars of Victory, Trajan's column at Rome, a Roman Doric pillar 115 feet high, freely sculptured, is the most famous. Around the shaft, like a spiral band, runs a winding relief, telling the tale of some of Trajan's exploits. A statue of St. Peter now stands on the top of the pillar in place of that of the Roman emperor. In the Victoria and Albert Museum, South Kensington, London, is a plaster reproduction of the Trajan column. Another famous pillar was the Marcus Aurelius column, similarly decorated.

The Romans built fountains in great numbers. There were hundreds of them, public and private, in their cities. They erected them partly out of their love for running water and the coolness of the tossing sprays from the fountain's jet, and partly in memory of municipal events and distinguished persons.

There was only a certain amount of marble to be had by the Roman builders. But they had plenty of terra-cotta, stone and brick. And early in their development they invented a new material, concrete, whose appearance is a landmark in the history of building construction.

THE MANY USES THE ROMANS MADE OF CONCRETE

We know from existing portions of the Roman Wall in London how enduring their concrete was. It consisted of a mixture of lime and a peculiar sandy earth called *pozzolana*. Once they had discovered its granite-like qualities, the Romans used their concrete freely, not only as a strengthening substance, but as a building material itself. They made walls, domes, vaulted roofs of solid concrete, or concrete with brick ribs, and faced the structure with marble, brick or mosaic. This use of concrete has served as a model to builders down through the centuries to the nineteenth, when steel came into use.

As masters of the new medium, the Romans became independent of local conditions in any new, conquered country.

Concrete and bricks could be made anywhere; in nearly all lands there was native stone. Thus it happened that their construction was practically the same all over the empire.

The Romans are intensely interesting as builders, even if they were not great artists in architecture. Their construction was what one would expect from so strong a people. Whether it be fragments of walls or patches of mosaic—wherever anything Roman is delved out of the earth it becomes an object of envy to the modern builder. The watchword of the Imperial architects was: "To Endure." Hence that saying, "When falls the Colosseum, Rome shall fall."

After the lapse of time these great people are remembered most for their engineering works and for their domed and vaulted temples. It was natural to them to erect huge buildings. They must have been conscious of the greatness of Rome when they flung up the great dome of the Pantheon. It is interesting to note that stupendousness in architecture like that of the East came into Europe by way of the Romans.

The Pantheon, which is now a Christian church, is the most wonderful temple Rome produced. It is the earliest domed building of which any trace remains, and, being in a good state of preservation, is a guide to Roman architecture of this kind.

THE WONDERFUL OPEN DOME THAT CROWNS THE PANTHEON IN ROME

The entrance, a magnificent portico of Corinthian columns, with a sculptured pediment, must have reminded the Romans of the Greek temples they so admired. But behind these ranked columns, over the rotunda, or circular hall, rose something Greek architects never thought of: a huge round dome where light is spilled through one great central hole in the roof. When the Pantheon was in its glory of color and gold and all the enrichments of its artists, the effect of this "eye of heaven" shining down aslant the dome must have been glorious and awe-inspiring.

Among the other sacred buildings which inclosed a polygonal or a circular dome were: the Temple of Vesta at Rome, the earliest and most sacred of them all, built about 715 B.C.; another to the same goddess at Tivoli; the Temple of Jupiter at Spalato; and that of Venus at Baalbek, in Syria. Of their many rectangular temples resembling the Greek, the best preserved and finest example is a building now called the Maison Carrée, at Nîmes. Another fine one, which has suffered at the hands of time and enemy peoples, like most of the temples of this class in Italy, was the Great Temple at Baalbek. Within all the public buildings, sacred and secular, stood a great array of Greek statues, pillaged from their home.

Of their palaces, basilicas and public baths, only ruins remain, and we cannot but deplore the loss of such characteristic buildings of a great people. The baths were colossal. One writer has described them as towns in themselves, with their corridors and halls for exercise and rest, and their gardens, all grouped round the chambers of the bath. Here the luxuriousness and grandeur of the Roman displayed itself. We can best visualize them by imagining the apartments of ordinary Turkish baths built like a palace for grandeur.

THE TOWN THE ROMANS BUILT WITHIN THE WALLS OF A PALACE

This same sense of largeness strikes us when we think of their palaces—of the group on Palatine Hill, Rome, partly excavated, imposing even in ruin, and the palace at Spalato, in Dalmatia, within whose walls a town was afterward built.

The basilicas were large halls where commerce was carried on and courts of justice held. They are interesting to us now as forming a link between pagan and Christian architecture. On their model were built the first imposing churches of the early Christians.

Of the Roman theatres there are interesting remains at Orange, in southern France, in Rome and in Athens. They were built somewhat on the lines of the Greek theatres. One of the differences lay in apportioning the central part, which had been assigned to the Greek chorus, to Roman dignitaries and various other important persons.

Amphitheatres were a Roman invention—very characteristic of a martial, active people who gloried in physical exploits. Hence their gladiator shows, whose tradition remains in the Spanish bull-fights of to-day.

The Colosseum, built the first century after Christ, was the greatest of these amphitheatres. Another fine amphitheatre is in partial ruin at Verona.

THE NEXT STORY OF THE FINE ARTS IS ON PAGE 5465.

BUILDINGS OF GREECE AND ROME

THE PARTHENON AS IT STANDS TO-DAY ON THE ACROPOLIS OF ATHENS

THE PROPYLÆA—THE APPROACH TO THE ACROPOLIS OF ATHENS

THE NORTH PORCH OF THE ERECHTHEUM ON THE ACROPOLIS

THE CHORAGIC MONUMENT OF LYSICRATES AT ATHENS

THE TEMPLE OF THE WINGLESS VICTORY ON THE ACROPOLIS

THE TEMPLE OF THE OLYMPIAN ZEUS AT ATHENS

THE GREEK BASILICA AND TEMPLE OF POSEIDON AT PÆSTUM, IN SOUTH ITALY

COLUMNS OF THE TEMPLE OF CASTOR AND POLLUX AT ROME

THE COLUMN OF MARCUS AURELIUS AT ROME

A LITTLE TEMPLE AT TIVOLI, A FEW MILES OUTSIDE ROME

THE BEAUTIFUL MAISON CARREE AT NIMES

THE PONT DU GARD, THE MARVELOUSLY PRESERVED ROMAN AQUEDUCT AT NIMES, IN PROVENCE

THE GREEK TEMPLE OF CONCORD AT GIRGENTI, IN SICILY

THE DORIC COLUMNS OF THE PARTHENON

THE ROMAN COLOSSEUM AT EL DJEM, IN TUNIS

THE INTERIOR OF THE GREAT COLOSSEUM AT ROME

COLUMNS OF THE TEMPLE OF APOLLO AT CORINTH

THE TOWER OF THE WINDS AT ATHENS

THE TEMPLE OF NEPTUNE AT SUNIUM

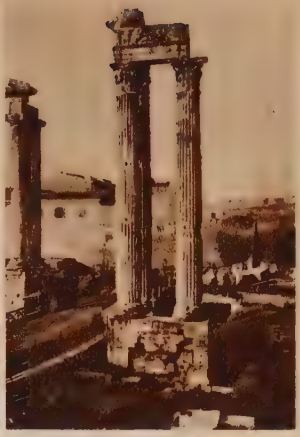
THE THESEUM AT ATHENS, THE BEST PRESERVED BUILDING OF ANCIENT GREECE

THE TEMPLE OF APHAIA AT ÆGINA

THE OLD GREEK TEMPLE AT SEGESTA, IN SICILY

THE COLUMN OF PHOCAS IN ROME

THE ROMAN CORINTHIAN TEMPLE OF BAAL, IN SYRIA



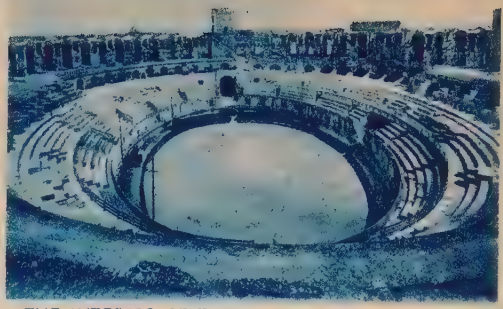
COLUMNS OF THE TEMPLE OF VESPASIAN, ROME

THE GREAT ROMAN ARENA AT ARLES, IN PROVENCE

A ROMAN BRIDGE AT PERGAMUM, IN ASIA MINOR

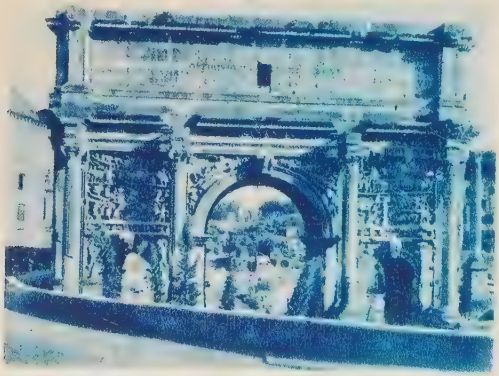
THE ROMAN THEATRE AT ARLES

THE TEMPLE OF BACCHUS AT BAALBEK, IN SYRIA



THE INTERIOR OF THE ROMAN ARENA AT ARLES

THE COURTYARD OF THE HOUSE OF THE VETTII AT POMPEII



THE ARCH OF SEPTIMIUS SEVERUS, AT ROME

THE AMPHITHEATRE AT POLA

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The Pool of London through which much of the world's wealth passes.
From the painting by W. L. Wyllie.

HOW WEALTH IS CREATED

MAN is by no means the strongest of the animals, and with nothing but his muscles to help him he can do little or nothing to resist the onslaught of a lion, a tiger, a bear or a gorilla. Fortunately, however, his muscles are directed by a wonderful brain, which enables him to contrive a thousand devices to conquer nature.

Labor is the first source of the wealth we are studying, but it is important to see that labor, to be effective, must be intelligent and informed by invention.

It is not the *amount* of labor we do which creates wealth, but its *effectiveness*. As we have reminded ourselves, man is a small creature, much weaker than many of the higher animals. It is a common error to speak of labor as the source of wealth, as if any amount of hard work could create an abundance of commodities. The truth is that wealth increases, not through *making* work, but through *saving* work.

As long as man worked with his own hands, or with the aid of a few simple tools and weapons, he spent nearly the whole of his life in obtaining a scanty supply of food. No matter how rich the territory he inhabited, he could not become wealthy or enjoy much of comfort or culture. A very striking illustration of this is to be found in the case of the United States, which now supports over a hundred million people. Not very long ago in the world's history this territory, with all its wonderful wealth of rich prairie land, timber, fine rivers, natural ports and magnificent stores of animals, was the home of a small number of savages, who hunted for a scanty living, and failed to multiply because they did not know how to use the natural gifts about them. The smallness of their wealth was the result of the failure of hard, unintelligent work to create commodities even in circumstances of a most favorable character.

But to labor aided by the inventions and discoveries of clever men, and exercised in a properly organized way, the possibilities of wealth production are for practical purposes unlimited. We of to-day are very fortunate in being the heirs of all the ages—the inheritors of the work and genius of every great man and woman of every nation. We have a greater opportunity than ever existed in the world before.

It is as true as it is remarkable that the great inventions and discoveries in history have been the work of a few people. Even if we include the small

inventions, the number of people to whom we are indebted for the modern means of making wealth amounts to a tiny fraction of the people who have lived in the world. If we are ever tempted to be proud of using such inventions as the electric light, or the railway train, or the steamboat, or wireless telegraphy, we shall do well to remind ourselves that we did nothing to bring them about, and that the least we can do is to use them intelligently.

When we organize labor to make it effective, we have seen how it comes to be divided up between individuals, between trades, between territories and between nations, in such a fashion as to get the best results. By organization we can make ordinary people, or even stupid people, as effective for many purposes as if they were very clever indeed, while we can raise the value of all the people concerned, whether individually clever or not. If a man invents a tool, the tool is the embodiment of his cleverness, and if he remains the sole user of the tool, the value of his exceptionally clever brain is confined to the one possessing it. If, however, he shares the secret of his tool with others, each one who has it at once becomes a clever worker, by virtue of a tool he could not have invented for himself. So men become, as it were, *clever at second hand.*

How the world pays in poverty for the neglect of science

The arrangement of work in such fashion as to make it fruitful is a very important thing, and not everyone has the gift of happy arrangement. What we need for the best results is the organizing of the working of the best processes and inventions, and we owe a good deal to the men who are capable of that.

Organization and invention between them save work, and in saving it, set free labor to do other work. This is a most important economic truth, for the neglect of which we pay in poverty and distress.

Let us think of a hundred people working on an island and entirely dependent on their own labor. If the labor of all the hundred is needed to find enough food to keep them alive, that food is their sole wealth. They can possess nothing more, because all their efforts are needed to feed themselves, and they must feed or die. Therefore, in such case, they cannot have clothes, or houses, or furniture, or any other comforts. But suppose clever ones among them invent good weapons with which to hunt—weapons so effective that only fifty people are needed to feed the hundred islanders. In that case the work of fifty food-getters is saved, and therefore fifty persons are set free to do other jobs. The fifty, being set free, can set to work to construct huts and fashion garments. The little community becomes richer, not because more work is done, but because a particular form of work has been saved. Suppose the fifty remaining food-getters, by further inventions, become twenty-five, then twenty-five can produce the food needed by the hundred islanders, and seventy-five are free to do other work. So again, the islanders become richer *because work has been saved.*

The great difference between making work and saving work

This process of *saving labor* is just as true in a great nation, as in the little island we have imagined. A nation can only become richer by means of organization and invention continuously *setting labor free to do fresh work.* That is why the idea of making work is a fallacy—a deceptive thing. Sometimes workmen are tempted to think that if they can spin out a piece of work, or refuse to use a labor-saving machine, they will make more work for others, but the very reverse is the truth. It is only by saving work, by using inventions as freely as possible, by producing as much as possible, that we can make things better for other people. He who makes work, in the sense of taking an unnecessarily long time to produce a thing, makes poverty; he who saves work, in the sense of producing as quickly as possible and as much as possible with the least amount of labor, creates wealth and employment.

We see, too, how important it is to use the word labor broadly, as describing all human effort by hand and brain, and not to apply the term to muscular effort or manual work alone. Labor is made up of muscular effort, or skill in the use of tools and machines; and of mental effort, either in its highest form as original invention, or in the trained performance of services involving measurement, or calculation, or arrangement, or enterprise.

The great value of enterprise in the life of the world

Not the least of the mental processes is enterprise. We apply this term to the

taking of risks in trade, finance or manufacture. It embodies courage and judgment as well as intelligence. A man may be intelligent enough to invent a new process, yet lack judgment as to how to use it, or the courage to put it to the test and to risk money in making it a success. Enterprise is a quality which some men have in abundance and others lack altogether. It is a valuable quality and has always been freely recognized among peoples who do not possess it. Boys playing a game, or savages needing a chief, or civilized men looking for a leader, usually find one among them who sees clearly what to do.

This wonderful and complex thing we call Labor is exerted under certain conditions provided by Nature. The *gifts of Nature* play a most important part in production. These gifts are many, and they are sometimes conveniently summed up under the single term Land, as we summed up the many forms of manual and mental effort under the single term Labor. Professor Marshall, the economist, describes land as meaning "the materials and the forces which Nature gives freely for man's aid in land and water, in air and light and heat."

How science has opened up Nature's great stores for man

Man is a land animal who learned with difficulty to cross water and to transport goods across the seas. For a long time man had to be content to inhabit land surfaces, and to utilize little more than was near the surface. If minerals outcropped, or could be readily quarried, he could get at them, but if they were at a depth, they were unobtainable by him. In modern times the use of steam and electricity and machines has enabled us to mine to great depths and so make use of the natural stores of coal and minerals which were formerly neglected.

The term Land as an agent in the production of wealth has thus come to have a very wide meaning, including not only all that is on the surface of land and water, but all that science can discover in them or beneath them.

We have now dealt with two great factors in wealth production—Labor, or human efforts; and Land, or natural gifts. We now come to a third and exceedingly important thing known as *Capital.*

The word Capital is from the Latin word *caput,* meaning "head." The head city of a country is its capital. So with a business. When company trading began, the stock of goods, or instruments, or machinery, or buildings, which it employed was called its *capital stock,* and this came to be shortened to *capital.* The capital of a business is the stock with which it works.

Good work cannot be done without an appropriate stock of things to work with or to work on. One great difference between the work of a savage and the work of a civilized man to-day is that the savage worked with a very tiny stock or capital, consisting of a few weapons, tools and pots, while civilized man works with a big stock of buildings and machinery.

The importance of capital to the progress of man

We have seen how invention has multiplied the powers of men and made them, even if not clever themselves, the users of clever things. It is important to see, however, that, if someone did not take the trouble to store up machines and instruments embodying inventions, the inventions could not be used.

Suppose someone invented a cheap method of extracting from clay the shining white metal, aluminium, which it contains. That would be a tremendous service to mankind, because aluminium is not only beautiful but useful. Such an invention would make all the difference to the powers of men, and we should employ aluminium for a thousand new purposes. If we think it over, however, we see that the new process could not be employed unless somebody found the means to set up the inventor's clever machinery. Someone must find the capital to utilize the new invention, or the invention will remain useless.

Let us take the case of a great group of inventions such as forms the basis of an electric railway. It is a marvelous thing, though familiarity robs us of astonishment that a heavy vehicle should move along rails with no visible motive force. A number of clever brains thought out the ideas which, embodied in wood or metal and roadwork, form an electric railway.

The ideas which make great enterprises possible

Yet, no matter how clever the ideas, the railway could not have been if some people had not stored up buildings to hold dynamos and the cars when not working,

the cars themselves, repair shops, a track and rails, and offices in which to control the whole undertaking. These things form the *capital of the railway*. They embody the inventor's ideas, and labor becomes fruitful because capital, working on natural gifts or land, has made it possible to work inventions.

Now let us think how it became possible for capital to be used. We see how important it is. Where does it come from?

We can understand this by taking simple cases. We can imagine a savage catching animals with his hands with great difficulty. We can then imagine him conceiving the idea of throwing a stick to kill a bird, or other animal, and of gradually improving the shape of the stick until it becomes a spear, or club, or dart. If we think of it, our savage, in fashioning his spear, is *storing up work to enable him to do work better*. In the hours in which he is shaping his spear he is really making a store of work, or saving up work. Having saved it, he possesses a spear which enables him to work better. If he has the sense to make a weapon out of the tusk of an animal he kills, he saves more work, and may come to possess a knife which will help him to work better still. The Eskimo makes a most effective knife out of the tusk of a walrus.

THE CONVENIENT FORM IN WHICH CIVILIZED MAN SAVES UP WORK

It is this saving of work which results in capital. The Eskimo's sledge, his dogs, his reins, his canoe, his knife are his humble capital, or stock. It is the result of his careful saving, and if he did not thus save he would perish.

The principle in civilized communities is the same. We have learned to exchange goods with each other by means of Money. By money we measure the value of things by a common standard, and money enables civilized men to save up work in a convenient way. Instead of saving up hats, if we make hats, or boots, if we are bootmakers, we can save up money. The money we can either use ourselves or lend to others to establish stocks of capital with which to use inventions, and to enable persons to be usefully employed in working on inventions.

Thus Saving becomes very important, for without it all the clever inventions of machines and appliances would be useless. It would have been in vain for Watt or Trevithick or Stephenson to invent the railway engine if people had not been found willing to lend money to make enough locomotives to run a railway. It would have been in vain for men to invent wireless if enterprising and saving people had not come forward to put their money into big wireless stations and elaborate machinery.

Now we see clearly what capital is. It is a stock of goods resulting from saving, and if no one saved, it could not exist. The person who thus saves and owns capital is sometimes called a capitalist. He may be either a man who has saved himself to form a business which he has himself organized, or he may be one who, having nothing to do with the business himself, has lent the money required to buy the stock needed to run the business.

WHAT IS MEANT BY THE LIMITED LIABILITY OF CORPORATIONS

Most modern businesses are owned by what are called stock companies, or corporations. Some have special charters granted by the lawmaking body, and others are organized under general laws. One of the advantages is the limited liability of the stockholders.

This limited-liability method of saving is very useful, and has done much to help enterprise and to create wealth. The meaning of limited liability is that a number of people can each contribute a small sum of money to make a big total sum, while the risk of each is limited to the sum subscribed. Thus a company may be formed to manufacture soap in a new way. If $500,000 is required, a thousand persons may each take one hundred shares of $5 and have no further risk. It might not be possible to find one person willing to risk as much as $500,000. That is how the limited-liability form of saving helps enterprise, increases capital, and in this way benefits the whole of the community.

THE THREE CHIEF FACTORS IN THE PRODUCTION OF WEALTH

Thus we have examined three things which we sometimes speak of—Labor, Land and Capital, the three chief factors in the production of wealth: Labor, as covering all human effort, whether of hand or brain; Land, as covering all the gifts of Nature which man may either use or neglect; Capital, the saved stores without which our labor is in vain.

THE NEXT STORY OF OUR OWN LIFE IS ON PAGE 5589.

WHAT ARE THE CEDARS OF LEBANON?

THE cedars of Lebanon are cone-bearing trees of the fir family, found growing on the slopes of the mountains of Lebanon in Syria. At one time there were thousands of them there, but now the grove to which this name is given is barely half a mile round. Half a century or so ago there were 400 trees, some of them said to be 2,500 years old, arranged in nine groups, but there are fewer now.

The cedar grove is about two days journey from Beirut, and is 6,400 feet above the sea-level and 3,000 feet below the summit of the mountains. Of course in other parts of Syria, and in Asia Minor, there are similar cedars, though none so fine or so old.

The Bible has many references to the goodly cedars of Lebanon, and their stately majesty appealed to the imagination of the Jews. "The righteous shall grow like a cedar in Lebanon," said the Psalmist, and Isaiah could think of no better illustration of the goodness of God to his people than that he should give them shelter from the burning sun by planting "in the wilderness the cedar."

The trees were often spoken of as "the Glory of Lebanon," and Solomon used cedar wood very largely in building his temple and palaces. It was from the slopes of Lebanon that he obtained these trees. Hiram, king of Tyre, sent his servants to cut them down for the use of his friend, Solomon.

A beautiful story is told of how the first cedar came to France from Lebanon. A Frenchman traveling in the Holy Land found a little seedling among the cedars of Lebanon and tenderly placed it in his hat, for want of a better place. His voyage home was rough, and took far longer than had been expected, so that the water ran short and each passenger on board had doled out to him only half a glass a day.

The traveler felt for his little cedar as for a child and every day shared with it his small allowance of water, so that at the end of the long voyage, though he himself was almost dying, his cedar had become a tree six inches high.

It was carried to Paris and planted in the Jardin des Plantes, and in time became a noble tree. Thither went the aged and infirm to sit under its shade; from a prison close by the prisoners looked out of their windows at its beautiful foliage; and then, when it was just a hundred years old, men cut it down to make way for a railway, so that now the steam engine passes over its withered roots deep in the ground.

WHAT WAS THE SWORD OF DAMOCLES?

Four hundred years before Christ Sicily was governed by a cruel monarch, Dionysius, whom the people greatly feared. Though hated, Dionysius was clever, rich, learned and powerful, and he had many flatterers around him. One of them named Damocles said to him one day that he must be the happiest man in the world.

"Do you believe it?" asked the tyrant, and then he added: "Take my place for a time and enjoy the happiness of a monarch." So saying, he left the throne to Damocles, who seated himself cheerfully in his sovereign's place. The courtier thought he would now have plenty of time to enjoy his rich state. He began admiring the splendor of everything around. He examined the rich details of the throne, but then there came a sudden terror in his eyes, for he saw that a sword hung over his head, tied with a horse hair. Poor Damocles was so terrified that all his blessings vanished; he hastened down to Dionysius and implored the monarch to deliver him from a position exposed to such constant danger. The expression "a sword of Damocles" is used to describe an ever-threatening danger, or any situation recalling that of the shallow-minded courtier who did not realize the uncertainty of power.

WHERE DO ALL THE SHELLS COME FROM?

The shells in the sea are the little houses that living creatures have made for themselves from their own outsides. The sea is crammed with life from the surface to the bottom, and from its edge on the shore to its centre. A very large number of the living creatures in the sea make shells for themselves, partly to protect them from fishes that would like to eat them, and partly to protect them from the force of the water. We call these creatures shell-fish, but the name is a bad one. No fish makes a shell, and these creatures are not fishes at all, but far lower in the scale of life. A fish is an animal that has a backbone and a skeleton that lies inside its body. The bodies of the creatures that produce the shells of the sea are soft, and have neither a backbone nor any other bones.

These kinds of creatures existed in the sea long before the fishes. When they die their bodies are gradually dissolved away, but the empty shell that was made by them remains for a long time. It is now much lighter than it was, for its inhabitant is not there to fix it to a rock or a seaweed, and so it is cast up by the waves on the shore, where we find it. Sometimes when we dig far inland we come across many minute sea-shells deep down in the earth. These shells prove to us that at one time, long, long ago, the sea used to cover that place. As the little creatures died their shells dropped to the bed of the sea and were gradually covered by layer upon layer of mud, until that which was previously the sea-bed at length became dry land.

WHERE AND WHAT IS THE LOUVRE?

The Louvre is an ancient palace of the French kings, now a museum, and stands in the very heart of Paris, by the river Seine. The site was mentioned for the first time in the twelfth century under the present name. One French word for wolf is *louve* and the place may have got its name because there were wolves about.

In the beginning it was a stronghold like the Bastille, and then a royal library. King Francis I had it reconstructed for his palace, and so it grew, the French monarchs building on through the following centuries. Emperor Napoleon III was the last who added to the already huge building. He had built the two wings which continue the palace on each side of the Carrousel Square.

All the greatest architects and sculptors have worked at the Louvre, which has now become the national home of art in France. It has two thousand paintings of the best masters, forty thousand drawings, a wondrous series of statuary of the ancient and modern worlds, and antiquities of all sorts from all lands. It is one of the richest collections in the world.

WHY DOES A POOL STAY ON SAND AND NOT IN A GARDEN?

A pool does not stay on sand. At the seaside it sometimes *seems* to stay, but that is simply because water from the sea is flowing into it, or because it is below sea-level, and water from the sea rises into it. But sometimes grains of sand are closer together than the particles of soil in a garden and so they may hold back water better. Clay is much better than sand for holding back water, and much water is retained underground by layers of clay.

THE SPLENDID CEDARS OF LEBANON

The cedars growing on Mount Lebanon, which were regarded by the writers of the Bible as the crowning glory of the plant world.

WHAT DO THE POETS MEAN BY ARCADY?

Arcady, an independent little kingdom of long ago, was inhabited by merry people who boasted that they lived before the moon, and saw its birth. They were known for their rural ways, their love of music, songs and poetry, and for their enjoyment of tranquil happiness.

In the time of the Greeks Arcady remained free, thanks to its high mountains; but later the poor little country could resist no longer. It was conquered, and was joined to Greece. Poets of the time always pictured the Arcadians as fortunate beings, so that nowadays Arcady means to our writers the place of purity, of faith, of love, the imaginary land where rural pleasures make everyone happy.

Arcadian has become a name for anything that reminds us of Arcady. We say, for instance, an Arcadian landscape, an Arcadian picture, for a country that has a happy view and happy beings there.

DOES A FLY-WHEEL EVER EXPLODE?

No. After an accident it is often stated that a fly-wheel has exploded, and the results seem to suggest that this is so. In fact, a fly-wheel breaks up with a crash and its whirling fragments wreck a building for reasons apart from explosion. The act of exploding is due to the sudden expansion of a substance, as of steam in a boiler, or gunpowder in a bomb. What happens when a revolving wheel suddenly breaks up and flies about is very different. Let us think it out.

If a ball on the end of a string is whirled round rapidly, the string becomes taut and the ball moves in a circle; but should the string snap, the ball will go off in a straight line in the direction in which it happened to be traveling at the moment the string broke. Even when it is held by the string as it whirls it is all the time trying to move forward in a straight line, but the string gives it an infinite number of little pulls which keep it moving in a circle. The tendency to fly off in a straight line is due to what we call centrifugal force.

Now, when a fly-wheel is revolving rapidly the same thing is true. The axle is in place of our hand, the spokes are in place of the string, and the rim resembles the ball. All the particles forming the circumference, every part of the rim, tend to fly off in a straight line, but by the force of cohesion, which holds the particles of a substance together, they are restrained. Sometimes, however, owing to a weakness in the metal of the wheel, or owing to excessive speed, the centrifugal force becomes stronger than the force of cohesion, and part of the flying rim breaks away and is hurled forward in a straight line, wrecking whatever it strikes. That, however, is not an explosion, though the results are similar. Heavy grindstones sometimes break up in the same way, and from the same cause.

WHAT IS THE TYPE KNOWN AS BRAILLE?

Louis Braille was born in France in 1809. When a child of three he became blind, but this terrible trial became a great gain to his fellow-sufferers. Braille was very clever, and in his eagerness for knowledge invented an alphabet to enable the blind to read with their fingers.

Each letter, figure or mark is represented by a combination of small holes cut out in relief on thick paper; each group of tiny dots arranged in different ways, corresponds to a letter. By gently laying his finger on the paper the blind man knows, from the number and the place of the holes, what letters they represent, and he gets on very rapidly with his reading, thanks to an extraordinary development of the sense of touch. The Braille type has also been used for music.

Nowadays large libraries of Braille books have been set up and kept up to date, thanks to the kindness of people who spend a little time every day copying printed books into Braille characters, a work requiring much patience. Louis Braille worked hard, became a professor, and devoted all his life to helping the blind.

WHAT IS MEANT BY A YANKEE?

No one knows for certain how the name originated, but the general explanation is that the Indians of Massachusetts could not pronounce the word English correctly and so called the colonists *Yengees* or *Yenkees,* instead. The colonists themselves borrowed the word and it came to mean a white resident of New England of colonial descent. For many years this was the common meaning. During the Civil War the Confederates often called all the Northerners Yankees. During the World War the Allies often

called all Americans Yankees, even if many of the soldiers did come from the South. So you see that different people at different times have used the word in various ways.

COULD A STONE BE DROPPED THROUGH A HOLE THROUGH THE EARTH?

It is believed that neither a stone nor anything else could be dropped through a hole from one side to the other of the earth, even supposing such a hole existed. The stone could, of course, be dropped into the hole at one end, and it would fall with ever-increasing speed, because gravitation would drag it toward the centre. When it came to the centre it would doubtless rush past because the tremendous velocity it had acquired would carry it onward; but now gravitation would be drawing it back in the other direction, and gradually it would slow down, come to a momentary stop, and then return toward the centre, where eventually it would become stationary, and remain.

It is only in theory, of course, that such a thing could happen, for probably, as there would be air in the hole, the friction, as the stone rushed against this on its way to the centre of the earth, would cause such terrific heat that the stone would be burned up, in the same way as a meteorite is burned up on rushing through our atmosphere.

HOW DOES A SIPHON WORK?

A siphon is a bent tube with one arm longer than the other. If it be filled with water, or other fluid, and if its short arm be dipped in water or fluid in a vessel, the fluid will flow from the vessel along the bent tube, and down the long arm till the vessel is almost empty.

The reason is that the extra weight of the fluid in the long arm and the pressure of the air on the surface of the water pull and push along the column of fluid. The fluid in the short arm must follow the falling fluid in the long arm, because it is pushed by the weight of the air. The pressure of the air on the surface of the fluid forces the water up the tube, just as the pressure of the air on the mercury cup of a barometer forces the mercury up the empty tube of a barometer, or as a suction pump draws water into pipes, or as the piston of a syringe draws water into a syringe.

But, as we know, the pressure of the atmosphere is able to raise water in a vacuum tube only thirty-three feet, so that if water be used and the short arm of the siphon be more than thirty-three feet long the air pressure will not be able to force the water around the curve. In such a siphon the water will flow out of the long arm, but the water from the short arm will not follow.

The siphons used for aerated waters are similar, but not the same in principle. In such siphons the pressure which pushes the fluid up the pipe is not the weight of air, but the pressure of the carbon dioxid gas given off from the aerated water; and in this case the arm through which the fluid escapes is shorter than the other arm, because the pressure is so great, and does not require gravitation to assist it. As we know, the pressure in the bottle is really so great that the liquid issues with considerable force.

WHY DO ORANGES NOT GROW IN CANADA?

Every kind of living creature has certain conditions in which it is fitted to live, certain places it inhabits. So we use a special word, and say that the sea is the *habitat* of the fish, England of oaks, Florida of oranges, and so on.

Some creatures can live in a greater variety of conditions than others; only one creature is known to keep himself alive in any part of the world, and that is man. Yet even he lives and works best neither in the tropics nor in very cold countries. Of all the conditions which affect the growth of living things, perhaps temperature is the most definite. Thus, when we go up a high mountain in a warm country, we can trace, as we go upward, different kinds of plant life, each corresponding to the different levels of the mountain as it gets higher and colder. The orange tree requires a hotter average temperature than Canada has, though by no means the hottest to be found anywhere; and if we alter this one condition of temperature we can make the orange tree grow in Canada or New York, as we may see in large greenhouses.

IS A MOUNTAIN HIGHER IN HOT WEATHER?

All metals and minerals expand with heat, and mountains, which are made of metals and minerals, will expand to some degree in hot weather, and will therefore be higher in hot weather than in cold. But the heat of the sun, even in the

tropics, will not be able to penetrate to any depth into the material of the mountain, so that only its surface will be heated and expand. The difference between the size of a mountain in hot and cold weather will not be measurable, but we must believe that the difference exists.

WHY DOES A HORSE NEED TO WEAR SHOES?

The loops of iron nailed to horses' hoofs seem very unnatural, for in their wild state horses require no shoes. But the shoes are necessary because the hard roads along which horses are driven would otherwise wear away the horn of the hoof. It is probable, too, that the hoofs of horses driven along dry roads become dry and unhealthy through lack of moisture. On their native pastures the wild horses bathe their feet every morning in the dew of the grass, and the moisture soaks into the horn of the hoofs and keeps it healthy and tough. All experienced horsemen know that dew is a splendid ointment for horses' hoofs, and it has been found that horses which are kept at night in dewy fields have such healthy hoofs that they can do a great deal of work without shoes.

But the chief reason why horses must be shod lies in the hard roads and stony streets, and as long as horses continue to be driven or ridden along such roads they will require iron shoes.

WHY DOES A RAILWAY ENGINE PUFF?

The puff of the steam locomotive points to one of the main characteristics of the celebrated engine, the Rocket, with which George Stephenson won the Rainhill competition by doing thirty miles an hour in 1829. When the steam of the locomotive has passed from the boiler into the cylinder and forced the piston along—and so moved the piston-rod, which works the connecting-rod, which turns the crank, which revolves the wheel, which moves the train—it is passed through a blast pipe placed in the smoke box under the funnel. So, with each movement of the piston there is a burst of steam through the funnel, and thus we get the puff-puff, which gives baby its name for a locomotive.

This way of getting rid of the steam has the great advantage of creating a strong draft of air through the furnace. It was by thus exhausting the steam, and by using tubes from the furnace through the boiler to make the water surrounding them hot, that George Stephenson was so successful in the famous competition. Although the modern steam locomotive sometimes weighs as much as three hundred tons, against the Rocket's four or five tons, it has the same main features of the engine of 1829. Before many years have passed, however, it may be that the puff-puff will seldom be heard in the land, because most of our railways may be electrified.

WHY DO THE LEAVES OF THE ASPEN TREE ALWAYS SHAKE?

It is true that small leaves move more readily and more often than large ones. That is what we notice if we compare the leaves of a horse-chestnut with those of an aspen or a birch. But even among small leaves some move more readily than others; and if we take the leaves of an aspen we shall see something about them which must help them to move as they do. It is that the little stem which carries the leaf is very much flattened from side to side, and so side-to-side movements of the leaf, which mean bending the stem from side to side, are easily made.

The more we study living creatures, the more we find use and meaning in the things they do and in the way they are made. When we are in a hot and stuffy room, we sometimes use a fan to help to move the air; and, indeed, we know that even a little gentle fanning makes a difference while it is going on. Now, a plant requires fresh air just as much as we do; indeed, in some ways the plant's need is greater, not only because the plant requires air to breathe, but also because the air contains part of the necessary food of all green plants. It would seem, then, that the shaking of the leaves of trees has the same effect as if the trees were fanning themselves: it moves the old air away, and brings a fresh supply to the surface of the leaves.

IS COCOA GOOD FOR US?

Cocoa is one of the best beverages for children. It contains very little stimulating substance, such as tea and coffee both contain, but it has a pleasant aroma and contains a good deal of nutriment. Sometimes the fat it contains upsets the digestion of children, and in such a case some of the brands which are almost free from fat may be used. More milk and fat may be added to increase its value as food.

THE NEXT WONDER QUESTIONS ARE ON PAGE 5515.

1736
JE SVIS VN CHIEN QVI RONGE LO
EN LE RONGEANT JE PRENDS MON REPOS
VN TEMS VIENDRA QVI NE STPAS VENV
QVE JE MORDERA QVI MAVRA MORDV

Photo, Ewing Galloway. **The tablet of the Golden Dog in Quebec.**

CANADA'S POETS AND PROSE WRITERS

PART II

FRENCH fiction in Canada has not kept pace with history and poetry. The first French Canadian woman novelist, Mlle. Félicité Angers, of Quebec, uses the pen name "Laure Conan." The best of her novels, which are written in pure and elegant French, was honored by the French Academy. A story considered by many the finest study of French Canadian farm life is Maria Chapdelaine, by Louis Hémon. This young author came from France in 1912 and spent a year and a half living among French Canadians while he wrote this, his last book. He was killed in a railway accident in 1913.

History proper is a form of literature in which French Canadian writers have taken high rank. L'Abbé Casgrain wrote short stories, poetry and critical studies, but his first attention was given to history. Another historian of the same time, Benjamin Sulte, had great learning and was untiring in his work. His books are full of matter for students. Excellent studies of the lives of leading characters in history and of other historical and political subjects have been made by later writers, of whom the foremost are: the Hon. Thomas Chapais, one of whose books was crowned by the French Academy; Alfred De Celles, formerly Librarian of the Dominion Parliament; and Laurent Olivier David, who has written accounts of Canada's history since 1837.

Among French Canadian literary leaders of to-day we must number Victor Morin, Louvigny de Montigny, Mme. Anne Marie Huguenin, whose pen name is "Madeleine," Georges Pelletier, Henri Bourassa, Hector Garneau, Omer Heroux and Olivar Asselin.

In English valuable historical writing has been done by Canadians about parliamentary government and practice. Alpheus Todd and Sir John Bourinot have produced standard works on these subjects. As for general narrative histories of the country, after an early History of Lower Canada by Robert Christie there came two long, detailed accounts by William Kingsford and J. C. Dent. There are brief, popular histories by Charles G. D. Roberts and Sir John Bourinot. Dr. William L. Grant has prepared a standard History of Canada for schools, and Emily P. Weaver has written several histories for young people, as well as stories founded upon history.

Oscar Douglas Skelton.

Among volumes upon special sections of history there are: Alexander Begg's Great Canadian Northwest; histories of the Hudson's Bay Company by George Bryce and Beckles Willson; George M. Wrong's A Canadian Manor and Its Seigneurs; Arthur Doughty's The Cradle of New France; Lawrence R. Burpee's The Search for the Western Sea; Judge Howay's History of British Columbia; the Reverend R. A. MacBeth's history of the Royal Northwest Mounted Police; W. H. Moore's The Clash, and J. Castell Hopkins' Canada at War.

Excellent political and biographical studies have been written by educators and men of public affairs, for instance: Joseph Pope's Memoirs of Sir John Macdonald; J. W. Longley's life of Joseph Howe; Dr. George R. Parker's Sir John A. Macdonald; Sir John Willison's Sir Wilfrid Laurier; M. O. Hammond's Confederation and Its Leaders; Dr. Oscar D. Skelton's The Canadian Dominion, Life of Sir Wilfrid Laurier and other works.

Critics, educational leaders and publicists are active in guiding opinion. Pelham Edgar, who is professor at Victoria College and historian, is the editor of The Makers of Canada Series and other texts. W. S. Wallace, of the University of Toronto Library, is editor of the Canadian Historical Review. His admirable volume of historical tales about Canadian explorers we should all look for. It is called With Star and Compass. Augustus Bridle is the author of Sons of Canada. Other leading critical writers are: B. K. Sandwell, Sir Andrew Macphail (also an essayist on political and social questions) and S. Morgan Powell, of Montreal; Hector Charlesworth and Fred Jacob, of Toronto; W. T. Allison and Thomas B. Roberton, of Winnipeg; Archibald MacMechan, of Halifax; and J. D. Logan, of Wolfville, Nova Scotia; and Dr. Scott of Vancouver.

The Hon. W. L. Mackenzie King is the author of a valuable book called Industry and Humanity. His picture is in the article on Prime Ministers, where you may read about him as a leading political economist. Two other writers on questions of political economy and public affairs are James Mavor, author of Wage Theories and Statistics and The Economic History of Russia; and J. W. Dafoe, editor of the Manitoba Free Press. Mavor has recently published also his reminiscences My Windows on the Street of the World. Miss Marjory MacMurchy is an able writer on the life and problems of women in Canada. She has also an excellent book, a series of loosely connected episodes of child life, entitled The Child's House.

Some of the Canadian Novelists

In the field of the novel, as in poetry, the great prophet has not yet arrived in Canada "to interpret her many-sided, but always vigorous life," although many men and women have been opening up the way by writing admirable stories concerning that life. One of the most interesting Canadian historical romances yet written, *Le Chien d'Or* (The Golden Dog), appeared in 1877. It was the first one by a Canadian writer in which was put to use a part of the great store of romantic incident that the country's early history holds. The name is taken from a golden tablet set upon the face of a building in Quebec and showing a dog gnawing upon a thigh bone. William Kirby, the author of the story, left England with his parents when he was a young lad and lived for seventy-five years at Niagara. He was a journalist and held office as a collector of customs for a number of years.

James De Mille, born in New Brunswick in 1833, although he lived less than fifty years and held the post of college professor, wrote more than thirty novels. The best are: Helen's Household, a Roman tale of the first century; and A Strange Manuscript Found in a Copper Cylinder.

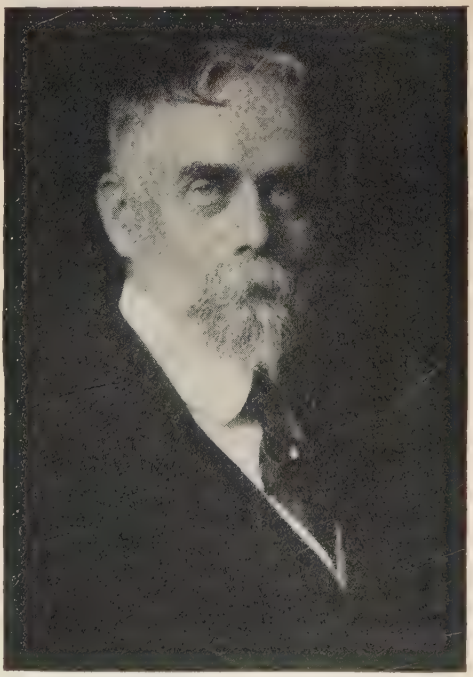
In 1849, in Ontario, was born Edward William Thomson, now dead, who became widely known as a journalist, editor, writer on public affairs, and author of excellent stories of adventure especially interesting to boys. His volume of short stories, Old Man Savarin and Other Stories, has taken its place as a classic.

Following along the literary road marked out by Kirby, Sir Horatio Gilbert Parker has built several novels against the background of Canadian history. The first was Pierre and His People (1892), which caught the public attention and brought fame to the writer. The names of the others are familiar to the reading world. When Valmond Came to Pontiac, The Seats of the Mighty, The Right of Way are some. The novelist was born in Ontario about the middle of the nineteenth century, went to school in Ottawa, taught school, studied for the church, then took up journalism. After several years in Australia, whither he had gone for the sake of his health, and where he became associate editor of the Sydney Herald, he settled in England. There he became a member of the House of Commons in 1900, was knighted in 1902, and raised to the baronetcy in 1915. His earlier literary works were plays and short stories, but it is as a novelist that he has taken a leading place. Among his later stories are The Judgment House, The World in the Crucible, and the fascinating story of La Salle as he describes it under the sonorous title of The Power and the Glory. All boys and girls will be eager to understand this really beautiful book.

Authors who have written of North and West

Agnes C. Laut, a native of Ontario who early went to Winnipeg to live, and studied at Manitoba University, has written a number of very well-known and widely read books about the stirring adventures of discoverers and explorers in the North and Northwest. Some of them are: The Lords of the North, Heralds of Empire, Pathfinders of the West, The Fur Trade of North America. Miss Laut has held important posts as correspondent and editorial writer on various journals in Canada and the United States. An important recent book about the Far North by one who has been there is The Friendly Arctic, the work of Vilhjalmur Stefansson, the explorer.

Of the West, again, but the West of more recent pioneer settlers, are the stories of "Ralph Connor," the Reverend Charles William Gordon, who was born in Ontario, but has served as pastor to western churches. Black Rock, The Man from Glengarry, The Prospector, and his other tales have a breath of vigor and boyish feeling. Hulbert Footner writes remarkably good stories of adventure in the Peace River country which he knows familiarly, and H. A. Cody, Robert Service and Madge Macbeth have made the Yukon a setting for exciting and interesting books of romance. The forests of British Columbia and other parts of the Pacific coast lands are given skillful portrayal in Bertrand Sinclair's interesting stories, Big Timber, North of 53, and others. Poor Man's Rock is one of his latest books. The Shadow Riders, by Isabel Paterson, is an unusually clever novel founded on Alberta politics. Ser-



Photo, courtesy Harper & Brothers, publishers.
Sir Gilbert Parker.

Arthur Stringer.

geant Ralph S. Kendall, of Calgary, writes of the experiences of the gallant Mounted Police. Life on the prairies has been pictured successfully by Robert J. C. Stead and Miss Martha Ostenso, whose Passionate Flight deals with life among the farmers of the Northwest. The author was born in Norway, but lived most of her life in Manitoba.

Among the best western stories written by a Canadian are The Prairie Wife, and The Prairie Mother, by Arthur Stringer, the variety of whose work and inspiration is remarkable. His poetry we have already mentioned. His prose has the quality of skillful direct utterance that cuts straight home to the heart of a matter. Mr. Stringer was born in Ontario in 1874 and educated at Toronto and Oxford. His first writing was in verse. He was engaged in editorial work in Montreal and New York until 1901, when he broke free to write as he pleased. His summer home is a farm beside Lake Erie, but his interests are broad and he has found food for his active thought in the many regions where he has traveled. His imaginative faculty works two ways: it transports him into the scenes he is describing and lends him the power of taking his readers with him. Some of his earlier books are: The Silver Poppy, The Wire Tappers, and Phantom Wires.

Hopkins Moorhouse, who writes well on economic subjects, is equally skillful in fiction. In Deep Furrows he gives a romantic account of the grain-growers' movement in the West. His more recent work has turned to the detective story for its theme. Frank L. Packard excels in exciting mystery and adventure tales. He is the author of The Miracle Man, The Beloved Traitor, From Now On.

Other Writers of Fiction East and West

Foremost among the best-selling fiction of Canadian authors is A Japanese Nightingale, published early in this century, under the pen name "Onoto Watanna." This and several other charming stories of Japanese life which followed are the work of Winifred Eaton (Mrs. Frank) Reeve (formerly Mrs. Babcock), who grew up in Montreal, and after a varied experience of journalism and authorship in the West Indies and the United States, now has her home near Calgary. Canadian and English reviewers join in praising the books of Mazo de la Roche, a woman novelist living near Toronto. These are Explorers of the Dawn, and Possession. Another most popular novel-writer, Mrs. Everard Cotes (Sara Jeanette Duncan), has not put into her books much that is essentially Canadian. They are of general interest. Some have to do with travel, and some with India, where Mrs. Cotes lived at one time.

On the other hand, most Canadian novelists set the action of their books in quite definite localities of Canada's broad expanse. There are the Nova Scotia stories, written by Charles G. D. Roberts—A Sister to Evangeline, The Forge in the Forest and By the Marshes of Minas. And Nova Scotia, her native province, has become for Mrs. Grace McLeod Rogers a field for study as well as a setting for her fancy's children. In Stories of the Land of Evangeline she has collected old legends, while in Joan at Halfway she has created new figures to people the old soil. Miss Marshall Saunders, too, has chosen Nova Scotia for her notable story, Rose of Acadie.

Prince Edward Island has been a far more real place to hosts of readers since Miss L. M. Montgomery sent Anne of Green Gables out into the world to let them into the secret of the island's

charms. Miss Montgomery (now Mrs. Ewan Macdonald) has published a number of other attractive books since Anne's first appearance. Mrs. Isabel Ecclestone Mackay, of Vancouver, writes with true understanding of children and gives her characters lifelike force. Ontario countrysides figure in her earlier books, but she has more recently gone to the Western coast, and is finding there a new setting for her romances.

Western Ontario during the days when early pioneer "bushwhackers" came into conflict with the first settlers who seriously went about the work of agriculture and the building of towns, Archie P. McKishnie has embodied in one of his stories, Love of the Wild. It is set in the Rondeau region, a part of the country which the writer knew well from his boyhood years. Mr. McKishnie and his sister, Mrs. Jean Blewett, of whom we have already spoken, have relationship through their mother with a famous Gaelic poet. Manitoba country life, with the problems that are particularly its own, appears in Sowing Seeds in Danny, by Nellie McClung (Mrs. Robert McClung), whose stories, quick in action and abounding in dialogue, find many eager readers. A quite recent writer, Miss J. G. Sime, shows unusual insight into human nature in her studies of life in Montreal. Her sentences not only move with ease but beckon the reader forward by their persuasive charm. Judge Emily Murphy, who has written on many themes distinctively Canadian, is best known to a wide public as Janey Canuck.

Others of note, writing most interesting novels and short stories, are: Harvey O'Higgins, Robert Watson, Douglas Durkin, Mrs. Evah McKowan, Marion Keith, Arthur Beverley Baxter, Will Ingersoll, Albert Hickman, Robert Allison Hood and A. M. Chisholm.

WRITERS WHO TELL OF LIFE ON THE SEA

Life on the sea offers much to the writer of fiction. The fascination never fails through all ages. For six summers Norman Duncan lived in Newfoundland and along the Labrador before he wrote his entertaining books that vividly represent the lives of the fisher folk on that harsh coast, The Cruise of the Shining Light, Dr. Luke of the Labrador, and others. In Blue Water, a direct, convincing account of life in a Nova Scotia fishing fleet, Frederick William Wallace has made the best story yet written of the North Atlantic deep-sea fisheries. Captain Wallace, who is secretary of the Canadian Fisheries Association, writes as one who has been in the midst of the life he describes. A storm at sea or a fight on deck is presented as a sailor himself would have seen it. This field has been further brought to light in Dr. Wilfred Thomason Grenfell's lively narratives founded on real experience.

We shall have to allow Stephen Butler Leacock a place all to himself, since his writings are distinctly his own in subject and treatment. His literary work has been an accompaniment to the duties of a college professor and lecturer. Beginning with serious writing—a book on political science and some biographical studies—he turned aside into a new domain in 1910, when he published Literary Lapses. Its light, amusing tone caught attention, and by degrees the book became popular. More have followed, among them Sunshine Sketches in a Little Town, and have met with great success.

Canada's leading humorist of farm life, Peter McArthur, now dead, had a successful and varied experience in journalism in Toronto, New York, and London, Eng-

Nellie McClung.

Mrs. Madge Macbeth.

land. His love of the farm can be felt in the wholesome humor of his prose and verse. Some of his books are: In Pastures Green, The Red Cow and Her Friends, and The Affable Stranger. His sketches have been called "sermons in a sugar-coating of delicious satire."

Another who writes in an entertaining vein signs himself P. O'D. His fun is to be found in the Toronto Saturday Night and in Imperfectly Proper.

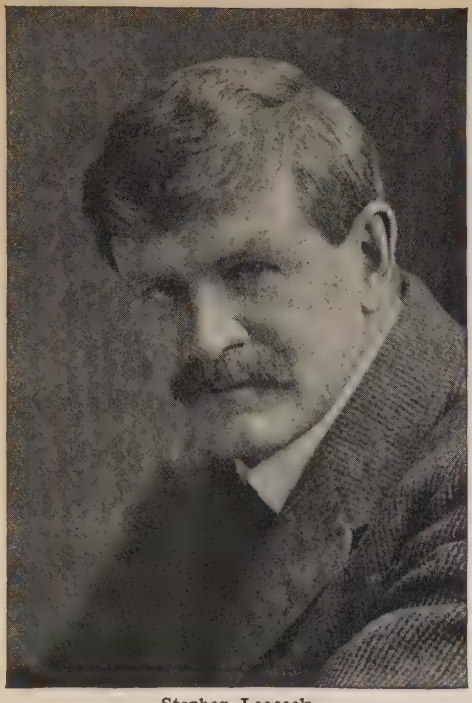
CANADA'S UNEQUALED WRITERS ON NATURE SUBJECTS

But above all other voices, the call of nature is of the strongest and most alluring for the Canadian spirit. Where such haunts of interesting wild life abound there must be eyes and ears and souls that cannot pass them by without pausing to study, wonder and admire. Here it is that Canadian literature steps far to the front, in the persons of such nature-story-writers as Charles G. D. Roberts, W. A. Fraser, Ernest Thompson-Seton, Arthur Heming and Marshall Saunders. We follow where they lead to the home-haunts of dumb wild neighbors—beaver, moose, grizzly bear or fox—or into the intimate life of some of man's closer companions, the domestic animals. The beasts are shown thinking and sometimes speaking as we do, and we know them better ever afterward.

When Ernest Thompson-Seton was only five years old he left England to live in Toronto. He was clever at drawing as a schoolboy, and later studied art at the Royal Academy, London, and in Paris. When he began writing his books about animals he was able to make them more attractive by drawing his own pictures to illustrate them. In 1891 he became naturalist to the Government at Manitoba, with the finest of opportunities to study wild life. And now we have his records of what he has seen and learned, in Wild Animals I Have Known, The Biography of a Grizzly, Lives of the Hunted, The Arctic Prairies, and other books. Another artist-author who knows intimately the life of the wilderness is Arthur Heming. He has illustrated the books of other authors as well as his own. In The Drama of the Forests he can be found in both his rôles.

William Alexander Fraser is a Nova Scotian, but has lived at different times in New York, Boston and India, and in Canada's Northwest, which he has ably interpreted in many of his stories. He knows well how to handle the writing of adventures, and his sympathetic portraits

Miss J. G. Sime.



Stephen Leacock.

of animal friends have made him a favorite writer. These are some of his published books: Mooswa and Others of the Boundaries, Thoroughbreds, The Lone Furrow, and Bulldog Carney. Margaret Marshall Saunders is best known through her famous little autobiography of a dog, Beautiful Joe, which has traveled well over the world and been translated into several languages. Golden Dicky, a story of a canary, and Bonnie Prince Fetlar, the autobiography of a Shetland pony, and Jimmy Goldcoast, the story of a monkey, are from the same clever pen.

Charles G. D. Roberts, in his boyhood home by the Tantramar marshes, used his eyes with keen intelligence and caught many of those sharp, clear impressions that fill his memory's storehouse with pictures which he has put into words, not only in his nature poems, but in nature stories as well. He can show us exactly how the beaver builds his dam. He can help us to see how the shy small wild things creep through the night woods, alert and ready for action. He can make a moose calf seem almost human in its appeal. Among his books on woodland life are: Heart of the Ancient Wood, Kindred of the Wild, The Watchers of the Trail and Red Fox.

The story of what Canada has done to keep her wild life is given in Dr. C. Gordon Hewitt's book The Conservation of the Wild Life of Canada. It is finely written and well supplied with pictures, maps and charts. Dr. Hewitt, who did much to secure Government measures for the preservation of game, had a short life. His book, finished just before his death, is his best possible monument. It is a work to bring pride into the hearts of all Canadians and Englishmen.

Not only the animal life of the wild has been put into books. Plant life, too, has its chroniclers. Mrs. Traill, long ago, wrote about the plants. And a present-day author, Mrs. Julia W. Henshaw, also botanist and lecturer, has especially studied mountain flowers. Among her books are The Wild Flowers of British Columbia and Wild Flowers of the North American Mountains.

And now we shall speak of several men who in their books speak of the past, making us feel how true it is and how it links Canadian life with the world life. Dr. Cyrus MacMillan, studying the oldest traditions and fables known in Canada, has discovered that some of them are plainly related to the oldest stories of the world. In his Canadian Wonder

Photo, Notman.

Dr. Cyrus MacMillan.

Reverend H. A. Cody.

Tales you will find The Indian Cinderella, The Boy and the Magical Booty, The Northern Lights, and many other charming folk stories. An authority on the folk-lore of the French Canadians is Dr. Marius Barbeau, of Ottawa. He has made, too, considerable study of Indian life. His Indian Days in the Canadian Rockies, illustrated by Langdon Kihn, has a general appeal.

Dr. George H. Locke, chief librarian of the city of Toronto, re-creates great men of Canadian history in When Canada was New France. His book shows the origin of many of the names and customs.

Dr. Ray Palmer Baker has explored another section of Canada's early life as a country, tracing the sources of her literature among the United Empire Loyalists. His History of English Canadian Literature to the Confederation is a careful and interesting review of many of the poets and prose writers we have been studying.

Canadians have been somewhat slow to develop a literature of the stage, in the sense of a body of plays that can actually be acted with effect in a theatre. But the Little Theatre Movement has now been going on for about ten years in several Canadian cities, and has begun to produce results. Among the playwrights whose work has been put on the stage Merrill Denison is easily the first in point of craftsmanship, having had a long experience of stage work in the Hart House Theatre at Toronto University. His book, The Unheroic North, contains several striking dramas and comedies of Canadian rural life. Marjorie Pickthall has given the Canadian theatre its most poetical play in The Wood Carver's Wife. Duncan Campbell Scott, Isabel Ecclestone Mackay and Fred Jacob have done interesting work in this sphere.

Do you realize how many threads are woven together in literary fabric—how many voices have formed a part of the national chorus? Not only those who, born in the land, have lived upon the native soil, but those who have wandered into other lands and those who have returned from other shores—all these have had a part in Canadian literature. One of the authors who in these later days left England for Canada, John Murray Gibbon, himself an admirable poet, critic and writer of fiction, as first President of the Canadian Authors' Association, leads in looking forward to the future for a development of the national genius that shall reach beyond anything that has yet been attained.

THE NEXT STORY OF LITERATURE IS ON PAGE 5459.

John Murray Gibbon.

WHAT THIS STORY TELLS US

THE stories of the missionaries to the American Indians in the early days are full of examples of bravery, particularly in Canada. The Indians of the colonies to the south did not seem to be so fierce. After a long time the Indians learned the power of the white man, and ceased to torture the men who brought them the story of Christianity. The good priest whose story is told below was not so much in danger of his life or of physical torture, but he gave his life to his people, and endured all manner of hardships in looking after his people. This is a story of heroism shown day by day in doing unpleasant things.

BLACK ROBE AND WHITE HEART

ON New Year's eve, 1839, Albert Lacombe, almost twelve, stood at midnight in the raftered kitchen of his house near St. Sulpice, Quebec. Very proud and very happy was he, for he was to repeat to his father the New Year's wishes that his mother had taught him. This is one of the pretty *habitant* customs that has not died out in French Canadian homes.

The night air was so frosty and still that the joyful chimes from the cathedral in Montreal, twenty miles away, blended with the peals from the gray-towered church around which the little parish of St. Sulpice clustered.

The lad's heart was filled with something like awe as he listened and waited for the music of the bells to die away. He noted that the vivid blaze from the wide fireplace, heaped with logs, flamed brightest on his brothers and sisters as they knelt about their father's knee. His mother stood in the deep shadows of the low room. She was thinking he believed, of her ancestress who many years before had been captured by an Ojibwa chief and was rescued by her *voyageur* uncle, who had brought her and her half-breed children back to her childhood home.

As the chimes rang out, the little formal speech was given. It closed with a request for their father's blessing, but to Albert's boyish loyalty his mother seemed left out. Turning to her, he cried impetuously: "And, Maman, you know how we love you!"

This unpremeditated outburst gives us the keynote of Father Lacombe's whole life. He traveled thousands of miles over the great high plains of the Canadian Northwest, over oceans and foreign countries, and always his cry was, to those who were within reach of his voice or influence, were they Indians, *métis* (half-breed) or white men, "And you know how I love you!"

Albert and his brothers and sisters lived with their father and mother on the farm in St. Sulpice. When not at school the boy was kept closely at work on the farm. He enjoyed making sugar when "sugaring-off time" followed the snowy winters in Quebec, but picking up stones on new land, feeding pigs, driving a plow—these were duties not so pleasant, and his thoughts were busy with plans for the future. Should he be a *voyageur* like his grand-uncle Joseph Lacombe, and go to the far, far West, where the fur companies sent men who were brave? His parents were so poor that he could not hope for their assistance in gaining an education.

One day a wonderful thing happened. The *curé*, driving a fat old horse, came to make a call. He spoke of the weather and of the crops. Suddenly he turned to the shy lad standing near. "My little Indian," he said,

for he was fond of Albert and knew the story of Madame Lacombe's ancestress, "what are you going to do?" Albert was speechless. He knew what he wanted; but how could he tell so grand a man as "Monsieur le Curé"? He looked up desperately at his father. So the kindly father explained that he could not afford to send his eldest child to school, although the boy longed for books and knowledge. The *curé* nodded, but made no further reference to his question until he was leaving. Then he called back, as he clambered into his old cariole, "You send him to college and I will pay his way. Who knows? Some day our 'little Indian' may be a priest for the Indians."

For years Albert Lacombe studied. He enjoyed his school, enjoyed his college. But like all real missionaries born, he grew to feel that school life and indoor life were not for him, and when he was twenty-two he started for the far country he had dreamed of ten years before. Travel was not easy then. His long cassock was often ridiculed, and the long trail from Montreal to Pembina, far out on the northwestern prairies as distances were then reckoned, seemed very long indeed, as it was covered by stage and steamer from Montreal to Buffalo, from Buffalo to Dubuque, Iowa, and from there to St. Paul, Minnesota. On the Mississippi steamer the first free air of the wilderness came to young Lacombe. "I began to breathe freely at last," he says of those delightful days. "I felt myself a new man."

When he reached St. Paul the scattered settlement of log houses that had but recently dropped the name of Pig's Eye were scant accommodations. His horror at being shown a coffin in which to sleep was genuine, but "It's much better than the floor," the frontier priest remarked. "We made it too short for one of my parishioners; but even so, it serves a good purpose."

From St. Paul on, the trail was harder and lonelier. The oxen drawing the creaking wooden carts moved slowly along the muddy roads. The marshes and creeks were swollen by the recent rains, and sometimes the carts and oxen sank so deep in a swamp that the whole party had to work in harness to drag them out. Pembina was reached at last, and there began Father Lacombe's years of service to the Indians and *métis*. He learned many Indian languages; went with the Indians on their annual buffalo hunts, when the unnumbered bison roaming the prairies looked like the type on this page, so closely did they feed; taught the children; baptized all who would accept Christianity; worked and loved. That was the Golden Age for the Indians, for the bison supplied them with three great necessities of life—food and clothing and fuel—and they were brave and independent and free.

Finally the missionary was sent farther west. From St. Boniface and Fort Garry to Edmonton House, then the most important trading-post of the Hudson's Bay Company west of Fort Garry, he traveled by way of Cumberland House. From there ten York boats conveyed the party up the Saskatchewan. Alas, Father Lacombe's dreams of the free life of the *voyageur* were not borne out by the reality of their tasks. Canoes had been done away with, and men hauled the heavy boats against the currents as horses hauled the boats on the Erie canal. Walking in mud, over rocks, through swamps, along cliffs, sometimes in water up to their arm-pits—small wonder the men were glad when they neared Edmonton House. Then they donned fresh red woolen shirts and knotted kerchiefs around their heads to make a brave appearance as they climbed the green banks of the Saskatchewan to the palisade-hid fort, trading-post, storehouses, and the deep roof of "Rowand's Folly," as the governor's house was called. The flagpole even was invisible; but the red flag bearing the well-known H. B. C. shook in vehement welcome as the western breeze blew over the ravine.

When the Blackfeet, Blood, Piegan, Strongwood and Plains Crees came to trade in spring and autumn at Edmonton House, Father Lacombe welcomed their coming as another opportunity to get acquainted with more Indians. He watched with interest as the men rode up, wearing skin shields on their arms, full quivers at their sides, eagle-feathers in their hair, and startling bright paint on their supple, half-naked bodies. Squaws and children, yelping dogs and clanging iron kettles added color and noise as they followed the ponies that drew the *travois*, or Indian wagon, formed of crossed poles on which was piled the camp equipment.

While the men traded their furs and skins for the things they wanted, the

squaws put up the lodges and made the camp. Soon every Indian, big and little, knew and loved Father Lacombe.

On and still farther on he traveled. He went to Peace River, Little Slave and Lesser Slave Lakes. He went to Jasper House, where Father De Smet, who brought the story of the Cross to the Flathead Indians in Montana in 1840, had gone in 1845 as peacemaker. It is at this place where the Athabasca River pours out from the Rocky Mountains, heading deep within their mighty gorges and ravines. Sometimes he was in forest fires, in floods, in blizzards. He wandered on foot, by boat, by pony or dog-team, even on snowshoes, and everywhere he went he was cheerful, sunny and hopeful.

When smallpox and scarlet fever came among the Indians, there, too, was Father Lacombe, with medicine and advice, no matter how far away he might have been at the time of the outbreak. When a tribe of Crees attacked a tribe of Blackfeet with whom he was camping, he went around the outside of the palisade holding his crucifix aloft and waving a red and white flag in an appeal for peace. In the noise of the battle the Crees did not hear him, and a low-lying fog shut him out of their vision. He called to the unseen enemy, he waved his flag, but his efforts were unavailing. Suddenly a bullet which had already touched the earth rebounded to his shoulder and, glancing off, struck his forehead. The wound was slight, but the shock was so great that he staggered and fell. The Blackfeet, angered afresh, set up a wild shout, "You have wounded your Blackrobe, Dogs! Have you not done enough?" When the startling word ran through the ranks of the Crees the firing ceased, and without waiting to meet their friend, the Man-of-the-Good-Heart, the Crees withdrew in confusion.

And so the years went on. The Northwest Mounted Police took charge of the country west of Winnipeg. The settlers came. Cattle, horses and wheat-fields increased. Railroads crossed the country the missionary had so often traversed. The fur trade diminished, and the buffalo vanished. The *métis* and Indians, who tried farming, with poor success, were starving. Meanwhile towns multiplied. Father Lacombe's Indians sorely needed his love and aid. He had known them brave and powerful, honorable and hospitable—now they were degraded dependents. Where had the wilderness gone?

There are but few places in Canada, England, and even on the Continent, to which Father Lacombe did not go to gather money and get grants of land for his poor Indians and *métis*. Queens, diplomats, emperors, even the pope himself, were interviewed, and never without instant response. His good works are so well known that one time at a banquet a toast was given in which he was compared to a carriage that long ago used to wend its way from one end of Rome to the other, and in which anyone who was in trouble might take refuge, whether he was innocent or guilty. The toast concluded with the words, "He lends himself to all, for all."

As the years slipped by, Father Lacombe finally settled down, at eighty-six, in a "Home" near Calgary which he had founded for the homeless children and homeless poor who might be stranded as the tidal wave of immigration swept over the plains he loved so well. His Indian friends were practically all dead. Yet his great heart had to find someone to father, someone who needed him, someone to love.

Shrunken and stooped, quieter than in the stirring years of wandering, yet with eyes and heart aflame to want and misery as of old, Father Lacombe's own words may well end his story.

"We are told that in the earlier days of the Church an old white-haired man, bent with age and particularly tried by the labors of a long, painful apostolate, being no longer able to walk by himself, was carried by his disciples into the midst of an assemblage of the faithful, where he did not cease to repeat: 'Little children, love one another.'

"This old man was the apostle St. John. *Eh bien* to-day you have before you another old man. I will say to you nothing else than what St. John said; like him I shall repeat to you, 'Love one another.'"

The good Blackrobe died soon after.

THE BOLD HERO OF THE MOUNTAINS

ALL countries cherish the name of some patriotic man who has fought for the liberty of his native land. Just as the United States has its Washington, Scotland its Wallace and its Bruce, Italy its Garibaldi, so the Caucasus has its Schamyl, who, for more than a quarter of a century, struggled to keep the wild mountain land of his birth free from Russia's iron grip. He was weakly as a child, but his strength was developed by outdoor games and sports, and he grew up a sturdy youth.

Schamyl was absolutely fearless and such a youth of his word, that, when he found remonstrance without result in curing his father's drunken habits, his oath to kill his parent if he again transgressed brought the father to his senses. To the end of his life he abstained altogether from alcohol, knowing that Schamyl would carry out his threat.

When Schamyl was twenty-six years old, in 1824, he began his long fight against the Russian generals who were sent to subdue the land. He was a born leader, courageous in attack, skilled as a strategist, and clever in retreat. Many stories are told of his hairbreadth escapes from the Russians. Once his little band was surrounded by their enemies. If they could not fight their way through the bayonets of the Russians, they must either starve or be cut to pieces, for they knew not the word "surrender." Schamyl, who was ever the foremost and the boldest in attack, galloped alone through the enemy's lines and reached in safety his mountain fastnesses, as we see in the picture. He was the only one to escape with his life, and his pious Mohammedan countrymen believed the angel Gabriel had specially protected him. During another fight Schamyl killed three Russians, but was himself pierced through by a bayonet. Yet he slew his assailant, and got away as by a miracle. He was then chosen chieftain and ruler of the Eastern Caucasus by his compatriots. Little wonder that his people rallied to him as to a prophet who had been born to deliver their country from oppressors.

A mountain fortress long held by Schamyl was at last captured by the pick of the Russian troops, and again he was the only man to escape. It is said that he let himself down the steep rock by a rope to the river below, boarded a raft, and thus got away. Many generals were sent against Schamyl, but he eluded them all, and time after time rallied his countrymen to his standard. One general died through shame at being conquered by such a small band of mountaineers. Russia's attention was for a time diverted by the Crimean War; but, that over, new efforts were made to overcome Schamyl and his brave countrymen. The end was inevitable, for Russia's resources were enormous compared with Schamyl's. The latter took refuge in a little fortress on a hill in Daghestan, and there, when all except forty-seven of his men had been killed, seeing that even if he did escape there were no longer any patriots to rally, he submitted.

Schamyl was not a wild brigand, but a wealthy man of culture and high character, who ruled with justice and ability, was merciful to the Russian prisoners, and fought for love of his country and his people during many long weary years.

THE SOUL OF COUNTESS CATHLEEN

WHENEVER a neighbor came to the castle and asked, "Where is the Countess Cathleen?" the answer was always: "She is down in the village seeing after her vassals' welfare," or "She is at prayer in her oratory."

This countess of ancient Ireland was young, beautiful, and the mistress of broad estates. She lived like a nun, her whole life bent on serving the poor and worshiping God. Moreover, there was nothing harsh and self-righteous in her charity; it gushed from her heart as freely as a little fountain leaps from the hillside.

"HAS THE COUNTESS COME TO SELL?" ASKED ONE OF THE DEMONS

All was happiness in her fief till there came the year of the poisonous fog. A thick yellow mist rolled across the land, blighting the crops. Everything was soon covered with mildew; everything decayed.

Countess Cathleen did all she could to relieve the sufferings of the poor. Her courtyard was thronged with beggars, and she gave them daily rations from her winter stores. Still it was not sufficient, and no one could save the whole countryside.

Men and women died and left comrades almost too weak to bury them. Every face was marked with disease and want. Every day came news of someone's death.

One morning Cathleen sent for her steward, and said: "Fergus, you must go a long voyage for me. You must go to London with all my jewels and the title-deeds of my lands, and you must sell them, leaving me only this home. Then buy food and hire ships, and return as quickly as you can."

Fergus blessed his young mistress and set off. But there was stormy weather, and dawn followed sunset without bringing him back. The pangs of the people grew more terrible. They said that Fergus was drowned; there was no hope.

There was a wood near Cathleen's dwelling, and a forester's widow lived in the heart of it. One day when she came to the courtyard for a share of Cathleen's charity she told the others that lodgers had come to her house. They were richly dressed strangers who spoke to each other in a foreign tongue. They had abundance of food and wine in their luggage.

A few days passed, and one afternoon the woman came running out of the wood with horror in her face. When her neighbors could calm her sufficiently, she cried: "Oh, they are demons! Don't go near them! Listen! They began to talk to me craftily about the famine, and then they said: 'Ah, we could end these poor

folks' trouble so easily! We have plenty of gold here, and the farmers have corn in their granaries that they hoard in secret so as to get better prices.' Then they began to hint that they would give their gold in exchange for souls! Oh, they are fiends, come to profit by our misery!"

A crowd gathered around her to hear the strange tale. By and by one man crept away. When his wife looked for him he was entering the wood.

He came back at eventide, brazen and laughing, the smell of wine on his lips, and his pockets clinking loudly.

To the widow's indignant question if he felt no shame the man replied: "No; you lose your conscience along with your soul, and that is a very comfortable state to be in."

"But what will happen when you die?"

The man frowned. "Till then I shall be happy."

After that footsteps could be heard coming and going all night long.

In a day or two Countess Cathleen said to her old nurse: "Oona, there is a change in my people. They look stronger. The hollows in their cheeks are filling out. But there is another change too. Their eyes are different; they are like the eyes of wild animals, fierce and unreasoning."

Oona hung her head and told the truth. From nearly every home on Cathleen's estate someone had gone to the fiends and bartered his soul for food-buying gold.

Cathleen's heart froze with horror, yet she did not rail against her people; she only pitied the more that misery which had brought them to do such a thing. For a while she sat silent; then she said: "Pray you, bring me my hood. I am going to the forest."

"Fiends cannot harm an angel," said Oona, and let her go.

A well-trodden path led Cathleen to the forester's lodge. She found it full of her vassals. At a table heaped with money sat two tall strangers. They wore golden circlets around their black hair; their skins were swarthy, their eyes aslant, and the hands in their embroidered gloves looked like claws.

"Has the countess come to sell?" asked one of them, smiling evilly.

"I have come beseeching you to release these poor souls," began Cathleen, but they interrupted her.

"No, madam, we do not undo our work. You are not wise to expect pity from the servants of Lord Satan. There is only one way of redeeming the souls your people have sold us."

"I will give all I possess," cried Cathleen eagerly, though she had little left.

"Our master is a collector of rare things," said the demon. "He would rather have one pure and perfect gem than hundreds of flawed ones. The soul of St. Cathleen would be a fair exchange for all these sin-flecked hearts."

Cathleen saw that there was no hope of mercy. She spread her hands over her face for a moment; then she turned and hurried from the place.

Returning to her castle, she went to the oratory. What happiness she had known in the silence and sunlight of that little room! Now she knelt to pray her last prayer, to say good-bye to her soul.

Then she went back to the wood. Her face was like marble as she drove the bargain. Every soul was to be released and a large sum of money was to be paid to Cathleen so that she might buy the people food. She signed a parchment on which the demons' terms were written out. Then she came slowly home.

At the same time all the village folk felt a warmth in their hearts. They were free; they could feel as human beings again, and the first thing they did was to drop on their knees and pray for Heaven's help to keep their souls. Presently the news spread, and now they prayed for her who had ransomed them.

She was pining to death. She could not live without her soul. Fergus, long delayed by contrary winds, came with shiploads of food—too late. The fogs began to roll away. Health and plenty promised to bless the people once more. But Cathleen, who might no longer pray, died one night as silently as a flower.

The next day the demons had gone. Folk said that they had carried Cathleen's soul to their master. The whole countryside mourned her as one twice dead.

But when her old nurse, worn out by weeping and watching, at last fell asleep, she saw a vision of a meadow in heaven. The saints walked there in golden garments, and Cathleen was among them.

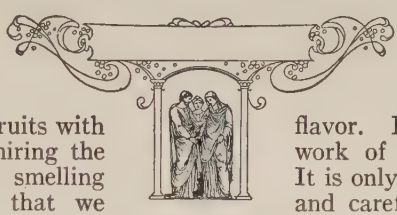
After all, the demons' bond was useless. For all her good faith it was not in Cathleen's power to give them her soul. It was no longer her own: it belonged to God.

THE NEXT STORY OF GOLDEN DEEDS IS ON PAGE 5735.

WHAT THIS STORY TELLS US

IN the following pages we are told of the wonderful work of Luther Burbank, of California. This man seemed to be able to change plants of all sorts as he pleased. Yet the means he employed were simple. The first plan was by selecting the individual plant which showed a quality he wished to increase. Then the seeds of this plant were sown, and the individual plants showing an increase of the quality were selected and the seeds from them were planted. The process was repeated again and again, until a plant very different from the original was secured. By crossing different varieties very many new and strange results were gained. You are told of some of the queer plants that Mr. Burbank produced, and are given a glimpse of what he hoped to do.

A MAN WHO LOVED PLANTS



TO be told that we need not go on from one year's end to the next eating the same kind of fruits with the same flavors, admiring the same kind of flowers, smelling the same fragrance; that we need not make our bread, even, with the same kind of grain—sounds much like a fairy story, indeed. One can scarcely believe that shapes, colors and perfumes of flowers may be of our own choosing, and that new trees bearing a kind of fruit never before known may be created at one's will. We are quite used to the fruits as we have them now, and think of them, no doubt, as having always been as they are. Changes have been made in the plant world, however, which are very wonderful.

For example, the strawberry as it is to-day is a much improved fruit over the common wild strawberry, its ancestor. And this improvement has come through the great care that has been given to the strawberry plants for a long, long period of time. At first people were satisfied with the small wild strawberry of the fields. If they transplanted it they took what they found and gave no thought toward making it better. Later, however, only the best plants were encouraged, and these were given every chance to do their best. In this way the art of making new strawberries came, and now we have berries which vary greatly as to size, color and flavor. But this has been the work of three hundred years. It is only after much intelligent and careful experimental work that we have been shown how nature's tendencies may be guided in a direction we ourselves choose, and bring results in a very short time.

Nature's way can be discovered so that anyone, without much difficulty, can breed new plants, new fruits, new flowers which will be more useful and more beautiful than any we have had before. Not only can new plants be called into existence but we can make those we already have much better. Better grains are promised, better vegetables in all forms, sizes and flavors; poisonous qualities may be taken out of plants so that we may have new eatable varieties; we may have plants that can resist the effects of the sun, wind, rain and frost as we already have fruits without stones, seeds or spines!

The man who was the most successful in changing and altering plants is Luther Burbank, known as the great American plant-breeder. He was born in Lancaster, Massachusetts, on March 7, 1849.

His father was a farmer who found time to read good books as well as to work his land. His mother had a

strong love for all beauty. Young Luther was a frail child who spent much of his playtime in reading. His great devotion to plants was noticed almost before he was out of the cradle, and his parents found that he appreciated the gift of flowers more than the present of a toy.

WHEN BURBANK WORKED FOR FIFTY CENTS A DAY

He went to the common school near his home and afterward to the academy in the town. But this higher school he could attend only in the winter, for he had to work in the summer to pay expenses. For several seasons the boy worked in a factory at Worcester, Massachusetts, his wages being fifty cents a day. On this small sum he found it impossible to live satisfactorily, so he set about the search for some means of adding to his income. He invented a machine which would do away with the work of at least six men. His employers increased his pay considerably, and his friends urged him to take up the career of an inventor. Burbank found, however, that the indoor work was bad for his health and he therefore returned to the land and took up market gardening and seed-raising in a small way.

On one of his potato plants he one day found a seed-ball in which there were twenty-three seeds. These he carefully preserved and planted. From the seeds grew twenty-three healthy plants, from each of which grew a different kind of potato. One of the plants was especially strong, and from this was taken a large cluster of potatoes which were unusually large and smooth, and of a very fine quality. The potatoes were sold for seed, which proved to be so good that the gardener who bought them called them the Burbank potato. It is said that since that time millions of dollars' worth of the Burbank potato have been raised in the United States. Burbank received $150 for his prize potato.

In 1875, as a result of a partial sunstroke which made him seek a different climate, he left New England and moved to Santa Rosa, California, where he made his home and carried on his work. Santa Rosa is a little California village lying in a fruitful valley. It seemed just the place for him to carry on the work he wished to do; for it has a wonderful climate, and its soil is rich and varied. Here, surrounded by his world-famous gardens, he lived in a cottage covered with vines and blossoms. His experimental grounds were at Sebastopol, close by.

He treated his farm as a laboratory in which he made experiments with all sorts of living plants. Some of his experiments covered a period of twenty-five years, or even longer. He was a tireless worker and never wasted a moment of time, or let anyone else waste it for him, and a large sign reminded curious visitors that they were allowed only five minutes in the gardens.

Mr. Burbank's ways with plants were no secret. Most of the changes he made in plant life were made either by selection or by crossing. We shall tell about the process of selection first, as that seems to be the simpler way of the two, and one that any man, woman or child might use if he only had patience and a love of the work.

WHAT SELECTION MEANS IN THE CULTIVATION OF PLANTS

You have already been told that there is a tendency in each plant to be different in some particular from any other one of its kind. No two plants are exactly alike. One is stronger than the other, the flower of this one is more brilliant than any of the rest, or another is larger in every way than its fellows. Mr. Burbank was always on the watch for the qualities which he valued most, and which he wished to appear in the new plant he had in mind. So he often sowed from a hundred to ten thousand seeds of a given sort. When these grew up he selected ten, fifty, or it may be only one, of the plants, and these he let live. He brought the flower to fruit and let the seed ripen. The seeds of the chosen flower were in turn planted, and a selection again made from that group. Sometimes this selecting and replanting was done again and again before he was satisfied with the result. Thousands of experiments were often made to get one plant, while millions of plants were produced, then cast aside, that a few might be found worthy of cultivation. Mr. Burbank sometimes had as many as three thousand experiments going on at the same time. Perhaps the story of how his crimson poppy came will show best how this plan of choosing and selecting was used to bring an entirely new poppy among our flowers.

A MAGNIFICENT WALNUT TREE

This great tree, which is ninety-six feet high and looks as if it might be a remnant of the primeval forest, was only twenty-two years old when this picture was made, and was grown by Luther Burbank from the cross of a black walnut which grows in the East and another black walnut which is a native of California. In the year 1878 Mr. Burbank began to make experiments with walnuts. Some of them were failures, but after seven years of patient, painstaking labor he produced two valuable walnut trees. This picture shows us the Royal walnut tree. In the corner you see a picture of Mr. Burbank in his garden.

Inset portrait, photo. International Newsreel.

How new poppies were cultivated from wild seeds

The fields of California are often golden with a wild yellow flower known as the California poppy. Mr. Burbank once noticed a little plant not quite like the others. It showed a delicate crimson streak on the inside of the flower. This was hint enough. He knew the crimson streak meant that crimson poppies had existed sometime in the past and that somehow they had been driven out. All they needed was another chance and they would come back.

We shall see how Mr. Burbank gave them that chance. He guarded the little flower with the crimson streak in its yellow. He raised young poppies with the seeds from this flower. When these poppies bloomed many of them showed a touch of crimson, and in some of the flowers more crimson was seen than was found in the mother plant. Another selection was made, and the flowers showing the greatest amount of crimson in their petals were chosen and treated as the others. Each generation of flowers showed more crimson than the one before, until the pure crimson poppy as we now have it came back to us. The blue Shirley poppy has much the same history. Out of two hundred thousand seedlings Mr. Burbank discovered one flower that showed a faint streak of blue. This blue was given its chance, and the rest was a matter of selection, time and perseverance. Mr. Burbank said he did nothing marvelous. He merely gave the crimson poppy and the blue poppy a chance to come back, and they came.

There seems to be no limit to the results that can be obtained by this plan of selection. It was in a similar way that Dr. Charles E. Saunders produced the famous marquis wheat. On page 1471 will be found the story of the experiments that led to this celebrated grain. On page 5614 is told something of the truth discovered by the Austrian monk Mendel.

The process of crossing varieties of plants

To make variations by crossing requires some knowledge of the structure of flowers. Yet, when one keeps in mind those parts of the flower which have to do with the production of seeds, it is all easily understood. The pistil is the organ of the flower which bears the seeds. It is usually in the centre of the flower and is surrounded by slender bodies with enlargements on the top. These slender bodies are the stamens. The enlargements are the anthers, which hold the yellow powder, or pollen, needed to develop the seeds in the pistil. When the pistil is full grown it is ready to receive the pollen. In a great many plants the pistils and stamens on the same flower are ready to do their work at different times. The anthers may have deposited all their pollen before the pistil is ready to receive it.

However, the wind carries pollen in all directions, and many insects, especially the bee, help to distribute it among the different flowers. But if no pollen at all reaches the pistil, the seeds cannot develop and the pistil dies. Again, if the anthers were cut off before they opened to discharge the pollen and the pistil were covered to prevent any pollen-grains from coming to it, the pistil would die. If all the flowers of its kind were taken away, the seeds could never be fertilized. All this is to show how necessary it is for the pollen to reach the seeds in one way or another.

How pollen may be brought from one plant to another

If, however, you should *bring* the pollen from another flower and deposit it upon the top of the pistil, you would soon find the pistil maturing and the seeds forming as if you had not interfered with the flower in the least. This is just what Mr. Burbank did so skillfully. He held the flower of a growing plant in one hand and with a camel's-hair brush took the pollen from the anthers of another flower and with it covered the pistil of the flower which he held. This gave the flower all the pollen it needed and just the kind he wished it to have. Then he covered it with a paper bag so that no pollen carried by the wind or the bees could reach it. When the seeds ripened they were gathered and sown, and the resulting plants were somewhat like both plants concerned in producing the seeds. From this generation Mr. Burbank chose again, pollinated again, and guarded the seeds with the same care. Chosen ones were kept from each generation. This went on and on, until Mr. Burbank either got the results for which he was working or saw that the results which came from his efforts were not what he desired.

NEW WALNUT TREES ARE DEVELOPED

It was in this way that the hybrid walnut tree came into existence. Pollen was taken from a flower of the English walnut tree and dusted upon the pistil of a flower of the native California walnut. Great care was taken of this flower, and the nuts produced were planted and watched with interest. In thirteen or fourteen years walnut trees thirty or forty feet tall had grown up, unlike either one of the parent trees. The trees are large and handsome, but they are not good nut-bearing trees. However, in spite of their rapid growth, which is about four times as fast as that of the English walnut, the wood is excellent. It is fine and hard and of a very beautiful color, and promises to be of great use to the cabinet-maker. A row of the hybrid walnut trees grows in front of Mr. Burbank's home.

Crossing in the same way the California black walnut with an Eastern variety produces the Royal walnut. This is a handsome tree, but it is of slow growth. It has, however, a great nut-bearing capacity.

Experiments with the various fruit trees resulted in one surprise after another. He gave us, all told, about sixty new varieties of plums and prunes, many new apples, new cherries, new quinces, and one absolutely new fruit, the plumcot, made by crossing the apricot and a Japanese plum.

PLUMS AND OTHER FRUITS ARE IMPROVED

There is the Bartlett plum with its interesting history. The story is told that as Mr. Burbank was eating a plum one day he noticed that it had a flavor similar to that of the Bartlett pear. He saved the pit, followed his usual plan of guarding and selecting, and the result is a plum which has the exact fragrance and flavor of the Bartlett pear.

The Climax plum is the result of a crossing of the bitter Chinese plum and a Japanese plum. We also have plums with extremely small stones and plums with no stones at all!

HOW NEW KINDS OF APPLES ARE MADE

Some apples he gave us are much larger and better flavored than those usually grown. The same is true of the cherry, peach and quince. One quince that he produced can be eaten raw, and has a flavor like the pineapple.

One would think that the length of time which a tree takes to grow would make it impossible to make so many experiments in one lifetime. This is ordinarily quite true, but Mr. Burbank overcame the difficulty by grafting his seedling plants on old trees. Grafting is placing a cutting from one tree under the bark, or in the wood of another. It is generally done in the way we have described on page 5959. If the work is carefully done, the graft becomes part of the older tree, and its growth is much quickened.

This graft draws nourishment from the fully developed circulation of the older plant. Were it not for this, we should have to wait years to discover what sort of fruit the new plant would produce. It takes from six to seven years for a plum tree to come into bearing. Out of thousands of seedlings the fittest (perhaps ten or twenty) are taken and grafted on the branches of a full-grown strong plum tree. In the next season that seedling will bear fruit. Sometimes twenty, or even hundreds of seedlings are grafted on one strong tree. In one instance Mr. Burbank had six hundred varieties of apples—green, red, sour and sweet—grafted on one apple tree. Plum trees, too, often carry as heavy a graft as this. If the fruits that result are all that is desired, the new apple or plum, or whatever fruit it may be, is kept, cuttings from it are grafted, and it soon increases in numbers.

NEW BERRIES DUE TO MR. BURBANK'S WORK

Next in extent to Mr. Burbank's work in plums and apples was his success in producing new varieties of berries. Here again we have a score of new varieties of great market value: better blackberries, raspberries, strawberries. The Primus is a cross between the Siberian raspberry, a small fruit about the size of a half pea, brownish, seedy and tasteless, and the Western dewberry. It has the best qualities of both berries combined, and a perfect balance of characters. It is ripe before most of the other raspberries and blackberries begin to bloom. He did not recommend this plant, however, for general cultivation. The Phenomenal, which is a cross between the California dewberry and the Cuthbert raspberry, is a

berry of very large size, clear red color and looks like a raspberry.

When he succeeded in growing a cactus without thorns it was said that Mr. Burbank had accomplished the most important task he had yet set himself. The cactus, as you know, is a fleshy-stemmed prickly plant. There are many varieties of cactus, most of them without leaves. The thick skin with which the plants are covered prevents the moisture which is drawn up through the roots from evaporating quickly, and in some varieties a store of cool liquid is found when the plant is cut. The fruit of some of the cacti is edible, as, for instance, the fruit known as the prickly pear, called opuntia, which is a member of the species. It was found, too, that if it were not for the spines with which they were covered, some of the plants would make good fodder for cattle.

How the Thorns Came Off the Cactus

To remove the thorns and improve the fruit was the work of much selection and crossing. An almost spineless opuntia cactus was used in the cross. In the first generation the stock was prickly, in the second, less so, and in the third, the cactus slabs were without thorns!

Mr. Burbank had five hundred kinds of edible cactus with fruits—yellow, crimson and green, and with varying flavors. They grow in great quantities and are ripe at all times of the year. With the thorns gone and the fruit improved, the cactus bids fair to be an excellent food for cattle, in dry regions. It has been used already in many places as green fodder, when other vegetation fails.

Failures as Well as Successes Are Met

One might go on and tell of thousands of experiments that this plant-transformer has made, but we have chosen here only those with results bearing directly on our life. But not all experiments had, in one sense, valuable results. Mr. Burbank had failures as well as success. He himself was often surprised with strange and useless outcomes. A strawberry was crossed with a raspberry. He got a plant that looked like the strawberry and which sent out underground stolons, strawberry-like. Later it sent up long canes from four to five feet high, in raspberry fashion. Then it burst into bloom and bloomed more than any strawberry or raspberry bush was ever known to do. But instead of the much looked-for berries it produced small green knobs.

Chestnut trees eighteen months old surprised him by bearing nuts two inches in diameter. Though but three feet tall, these trees were bowed down by the weight of their nuts.

Nature Is Sometimes Wiser Than Men

Sometimes the experimenter was reminded that Nature had been wiser than he thought her. When he wanted a walnut with a shell thin enough to be broken with the fingers, he knew how to get it. But the birds and the squirrels found an excellent and easily obtained meal, and it was of no use for Mr. Burbank to try to get any of the nuts for himself. So he had to have the shells on his nuts as thick as they were before. The same thing happened when he bred the prickly burrs off the chestnuts. Again, only the birds and the squirrels were benefited, and the burrs were allowed to grow on again.

When the white blackberry, which he called the Iceberry, was crossed with the red raspberry, about half the plants bore fruit like the red raspberry and the other half bore fruit like the white blackberry. But the flavor was that of both berries.

The Wonder-Worker's Dream for Mankind

Mr. Burbank worked no miracles. He said himself he just discovered tendencies in nature; then chose, encouraged and guided those tendencies in the direction he wished. And he said he could do this because the plant is so very, very old and so full of life. Nothing took too long to try, no failure was great enough to frighten him.

He lived very simply and quietly among the plants and flowers in which he took such keen delight and in his old age occupied himself in seeking to develop new seeds and fruits. "My dream," he said, "is that I may be able to point out to mankind the way to change the whole world of plants to suit its needs and pleasures."

A plan was formed in 1925 to transfer Burbank's experimental farm at Sebastopol to the control of Stanford University. Luther Burbank died in 1926 at the age of seventy-seven.

THE NEXT STORY OF MEN AND WOMEN IS ON PAGE 5481.

ROADSIDE PLANTS AND WEEDS

IF dirt is matter out of place, then weeds may be considered to be plants out of their proper places. There are many herbs that grow in an unobtrusive manner in their native country, but when transplanted to foreign shores, overrun the waysides and fields and choke out the flowers that belong there. The same thing, as we may read in the stories elsewhere in this book, is true of insects and birds and small animals, like the rabbit. Some weeds seem to be troublesome to farmers wherever they are —sturdy plants capable of surviving all kinds of ill-treatment and ready to seize any chance of bettering themselves.

Our roadside weeds, and the pests of the cultivated fields, have often come to us from abroad. They travel here in various ways. Plants brought over as keepsakes from old gardens have sent their seeds broadcast or have spread by runners. Seeds have been brought in with imported seed-grains and have spilled from vehicles, or been unknowingly sown. Burrs and other fruits have clung to wool and hides. In a hundred secret ways the weeds have crept in and humbly or arrogantly fought for a living. Once here, birds and beasts distribute them. Most of the weeds are so common that a mere glance at the pictures will discover some that we know. We shall soon notice, moreover, that many of them belong to the order of Bellflowers, which includes the Chicory Family, the Ragweeds and the huge family of Composites.

Perhaps this may be explained by the fact that these three families have fruits, called "achenes," that are small and dry, and each contain one seed inseparably wrapped in the tube of the flower's calyx. The sepals are deformed and now appear as teeth, or scales, or bristles, hard or soft, or as stiff prickle-like objects called awls. These form what is called a "pappus," and it may also take the shape of a little cup or crown. Sometimes it is not present at all.

This curious development of the seed-vessels and calyx has gradually been brought about, in most cases, to furnish each fruit a means of traveling. For each little seedling may find much better soil or conditions for growing in some other part of the field, let us say, than in the special corner where its parent grew. A study of weeds, therefore, includes a study of their seeds. Through this study we shall discover the interesting way in which seeds are carried from place to place and the means that each family has to send its seeds abroad. A study of the seeds also helps the farmer to find them and to destroy them.

THE SILKY PLUMES OF THE DANDELION

We have all taken a puff or two at the soft globes of a ripe Dandelion head to see what o'clock it is. In a little cloud the down flies away, leaving only one or two plumes sticking to the disk on top of the stem. Let us forbear to blow these away and look at them closely instead. We shall promptly see a little spindle-shaped achene topped with a slender stem bearing a tuft of downy bristles. Pouf! Away it goes, lighter than air, the tuft of down carrying the achene swinging beneath it far afield, springing in the eddies of the breeze until it strikes a tall bush, or the wind drops and the parachute falls to the earth, and the pointed end sticks in. It has barbs which prevent its blowing out again, and the parachute, having served its purpose, soon perishes. If in suitable soil—and nearly every soil is suitable for a dandelion—dust blows over it, or it sinks into a tiny crevice in the ground, and the early rains start it into growth.

It will continue to grow all summer, gradually choking out the grass in its vicinity by covering it with the deeply jagged leaves, which it arranges in a flat tuft of circular outline, like many other pasture plants. In this way it may escape being clipped by the teeth of browsing cattle. The dandelion does not hug the ground so closely as other weeds, but it is provided with a milky juice so bitter that no animal wants to taste it more than once. Oddly enough, this very bitterness recommends the plants to *us* as a spring salad.

By fall the dandelion has grown large and strong, and has stored much starchy nutriment in its firmly fastened root. Even its flower-heads are pretty well developed, ready to bloom into golden buttons during a warm spell. But then it is in danger again, for the root yields a drug, and is therefore dug up.

THE CHICORY CLOSES ITS FLOWERS AT NIGHTFALL OR BEFORE RAIN

Very closely allied to the dandelion is the Chicory, bearing flowers azure blue when newly opened, but often fading to pink, and sometimes occurring in a white variety. Apart from its jagged root-leaves the chicory is very different from the dandelion in appearance. It is tall and ungainly, the branches striking out at various angles. The foliage is gray-green and scanty, and generally dusty, for the chicory haunts roadsides and waste lands. Clustered in groups on the bare stems, at awkward intervals, are the flat heads nearly two inches across, setting close to the branches. They open wide when the sun shines, but toward sundown, or if rain seems likely to fall, close by raising the rays until these stand in a close group over the centre of the flower. This is in order to protect the precious pollen, which is placed in a perilous position by heavy dampness.

Each floret, tubular at the base, is prolonged on one side into a long strap-like ray which sticks out not unlike a tongue and is called a "ligule." Each ligule extends over a flower in an outer row and shelters it. A ring of five anthers with stamens united stands in the tube of the floret, and very quickly pollen is discharged through the inner slits of these anthers, filling up the tube, over the young pistil. The style of this pistil, however, when the pollen is freed, begins to grow, and as it grows it pushes the pollen up until it is piled about the opening of the tube, where rain would soon destroy it. During the closing process that we have described the florets are of course brought closely together and become pollinated by actual contact, which is made very sure by having the inner rays shorter than those of the outer circles, so that the "tongues" do not get in the way. Moreover, the stigmas of the outer rings mature before those of the inner. This is because, when the floret commences to fade, as happens just at the outer edge of the head, the branches of the style, which have been shut close together while the pistil pushed through the tube, begin to spread over and curve downward, and so expose the inner stigmatic surface, hitherto concealed, ready to pick up the pollen.

With slight differences, this description of the method of Pollination will answer as well for the dandelion as for the chicory, the mouse-ear hawkweed and the sow-thistle.

THE ORANGE MOUSE-EAR HAWKWEED

The pale yellow flower-heads of the Mouse-ear Hawkweed, poised solitary on slender stalks, are not unlike those of the dandelion, but the soft oblong or spatulate leaves, felted beneath with star-shaped hairs, are very different. It came here

THE WILD CHICORY

The chicory is an attractive flower, something like a dandelion in size and shape, but lilac-blue in color instead of yellow.

THE COMMON DANDELION

This is the real dandelion, although the name is given to other plants. What we call the flower is really a flower-cluster. It is used as medicine.

THE SPEAR PLUME THISTLE

Despite the contempt that attaches to the name of thistle, we must all agree that the spear plume thistle, when it grows several feet high and is crowned with purple flower-heads, is an ornament to the field. It is found in fence-corners.

THE COMMON SOW-THISTLE

The name sow-thistle has nothing whatever to do with the sow, but is from a Greek word meaning "hollow," referring to the stems. The plant is a favorite food for rabbits. It is also called the milk-thistle, because of the milky juice inside the stem.

from Europe and is a prostrate mat-like herb that sends long stems running over the ground, taking root at short intervals. It is a bad pest in parts of North America, like certain other allied species.

THE ORANGE HAWKWEED THAT RUINS FINE PASTURES

The Orange Hawkweed, or Devil's Paint-brush, which sends up a corymb of flame-colored flower-heads, is very striking, but also has runners and small seeds that, borne by a tuft of dusky white bristles, whisk into rich pastures and land that cannot be plowed, soon smothering the grasses with their useless but abundant foliage. Oddly enough, it is a very near relative of several of our own woodland plants, the rattlesnake-weeds, which meekly stay in the copses and do not overrun the fields as the imported species do.

THE COMMON SOW-THISTLE, ONE OF OUR TALLEST WEEDS

A striking weed, shooting up to a man's height, is the common Sow-thistle, or Hare's-lettuce, topped with small pale dandelion-like flowers, exuding a milky sticky juice wherever bruised, and with a spire-like effect caused by the graduation in size of the foliage from the large leaves of the base to narrow clasping ones at the top. It is fortunately an annual, haunting gardens and stubble-fields. Toward the end of summer the tall plant is fairly veiled in the whitish heads of the fruit, each with a tuft of soft pappus-bristles. They cling to one's clothes and to weeds, and blow away in groups.

THE BRANCHING GROUNDSEL WITH RAYLESS FLOWERS

The little Branching Groundsel has small tassels of greenish flowers that look as if the rays had all fallen away. As a matter of fact, however, they never had any, but the plant nevertheless manages to perfect its seeds, with their little tufts, and send them far afield, landing by preference in gardens.

A BRILLIANT WEED SAID TO BE POISONOUS TO CATTLE

A very close relative to the groundsel, the Ragwort, is a thick-rooted perennial, short-lived, fortunately, for it is declared to cause an odd but fatal disease of the liver in cattle when eaten by them. The old name Staggerwort may refer to this. It is a tall coarse plant bearing deeply twice-pinnatifid leaves, the segments waving over and under each other, very close-set and dark green in hue. Heavy showy corymbs of golden yellow flat flowers, with toothed rays, terminate the stalks. The seeds have a soft white pappus.

THE SPEAR-THISTLES ARE ROBBED BY THE GOLDFINCHES

Although we may have idly noticed that the Spear-thistle is apt to be growing in a fence-corner, or beside a rock, we have probably never even wondered why. It is a striking plant with stems armed with spiny ridges, the midveins of the leaves running down them, and with equally prickly foliage ending in a long spear-like point. The purple flower-heads are large and handsome. Although composites, the thistle-heads have no rays. They are simply tufts of slender tubular florets that are soon displaced by the achenes and the soft white thistledown, which are both so attractive to the lovely little goldfinches, who eat the one, unalarmed by the spines, and line their nests with the other. Each large achene, when the scales open slightly and allow it to escape, floats away, supported by its parachute of plumy bristles. There are two other very common weeds which have no pappus whatever.

THE OXEYE DAISY THAT TELLS A CHILD'S FORTUNE

We have all seen the sheets of white bloom that cover badly tilled or neglected pastures, where the Oxeye Daisy is in flower. "Whiteweed" the farmer calls the tall strong-smelling plant that chokes out the grass in his hay meadows and is despised by cattle. Yet it is a member of our cherished Chrysanthemum Family and is surely very handsome, with its pure white petals that children pick off one by one to see just whom they are to marry—"Rich man, poor man, beggar-man, thief."

The Yarrow, that pretty roadside plant with very finely divided fern-like leaves, is not a very noxious weed, although it is likely to give a bitter taste and strong odor to milk. It also furnishes a stimulant drug. The flower-heads, in flat-topped clusters, have greenish white disk flowers of a rather unusual color, and white rays, and the achenes are flat and oblong.

THE BURDOCK, WITH ITS TIRESOME BURRS

Another composite, which perhaps we have not always thought of as the cousin of the thistle and groundsel, has gone a step farther in the utilization of its

THE MOUSE-EAR ORANGE HAWKWEED

This plant is sometimes mistaken for the dandelion by those who are not botanists, its flower-heads being something like the dandelion's flowers.

THE COMMON GROUNDSEL

This belongs to the Daisy Family, and is one of the most widely found plants in temperate regions. The fluffy seeds are carried everywhere by the wind.

THE COMMON BURDOCK

This plant, with its balls of green bristles surrounding the flowers, is known to all boys, because each bristle has a hook, and when the bristly heads are thrown at anyone they at once cling to his clothes.

THE COMMON YARROW, OR MILFOIL

The yarrow is one of our commonest wild plants, and its flowers, which grow in dense clusters at the ends of the stems, vary from white to pink. The name is a corruption of "ye arrow," a reference to the shape of the leaves.

protective bracts, forming the involucre about the base of its globular heads of purple tube-shaped flowers. The involucre itself is almost ball-shaped, the florets protruding from the top; and the closely overlapping bracts are stiff and are shaped like a lance prolonged into long spines that are spreading or are hooked at the tip. This is the Burdock, a plant of dock-like appearance, and with fruits like burrs. One can easily imagine, from one's struggles with the fruits that have become entangled in the clothing, how far the burrs would be carried when firmly fastened in the woolly coat of a sheep or in the long hairs of a cow's or a dog's coat. The burdock therefore becomes a common roadside and waste-land weed. It has its uses, however; the long tapering root furnishing a medicine for blood and skin diseases, while the great fresh leaves form a cooling poultice for ulcers.

THE WILD CARROT, OR QUEEN ANNE'S LACE

At last we may leave the Composite Family and proceed to the umbel-bearers, in which we shall find one conspicuous plant, the Wild Carrot, which we should doubtless admire very much if it were not so common. Queen Anne's Lace the English children call the large disks of tiny white florets poised on slender stems. The outer ones have their petals enlarged on the outer side to make the umbel more showy. And always in the centre of the whorls is a maroon-colored floret—why, no one can tell. The finely cut leaves are as graceful as fern fronds. This is the plant from which our garden carrot has been developed by the gardener's patience. At night the umbel nods, to protect its florets, and when time ripens the seeds the ribs curve inward and the flower-head becomes a ball—a small tumbleweed that breaks off from the stem and is whirled over the snow to pile up in a corner and shed its seeds with those of other refugees.

HOW THE BEE FERTILIZES THE BUTTER-AND-EGGS

Another very pretty flower, or weed, is Butter-and-Eggs. In England people persist in regarding this as the snapdragon. It is the common toad-flax, so called because its leaves are long and narrow like those of the flax, and the closed lips of the flower are thought to resemble the muzzle of a toad. It is a bright clear yellow, and the lips are marked with deeper yellow or orange to show the bee where it opens to admit her in her search for honey. Her weight, as she alights upon a pair of knobs bulging from the lip, forces it down; and as she pushes into the flower she rubs under two pairs of large stamens arching under the upper lip, and drags out of them round balls of pollen.

Smaller insects cannot press this flower open. The flowers are crowded at the upper part of the stems, thus adding to their showiness, but, even before the plant comes into flower its numerous narrow leaves, of a whitish green color, make it look very pretty. Sometimes the five topmost buds of the raceme unite in order to form a monstrous flower of regular form with five spurs.

THE BUTTERCUPS THAT LITTLE CHILDREN LOVE

We can scarcely cross a meadow at any time of the year without finding a few buttercups, but it is in spring and early summer that we find them well in flower. There is a general idea that the name of these plants is due to the shape of the flower; but the old English spelling was "buttercop," and *cop* meant "stud" or "button."

Now, there are many kinds of buttercup in the Crowfoot Family, and it is very interesting to search for them and note the differences between them. One of the earliest to flower is the Meadow Buttercup. It is an erect plant with large stalked leaves, nearly round or five-sided in general lines, but divided into five or more parts, and each part is cut into several broad teeth. The leaves on the branched flowering stem are simpler in form, less divided and without stalks. The flowers on one plant are very numerous, and both sepals and petals spread wide and flat, so that the flower is more saucer-shaped than cup-shaped. It is common and has been introduced from Europe. There is one odd thing about the buttercups—the honey is secreted in a tiny depression at the base of each golden petal and is there protected by a little scale.

THE SHEPHERD'S PURSE HAS THOUSANDS OF TINY SEEDS

In the Mustard Family we find two weeds so unlike that we should find it hard to believe in their close relationship were it not for the four petals in the shape of a Maltese Cross.

THE MEADOW BUTTERCUP

There are many kinds of buttercups, and this one is found in meadows. Cup comes from "cop," a "head." The French name means "golden buttons."

THE YELLOW MELILOT

This plant belongs to the Pea Family, and is dainty and graceful, with its pale yellow flowers. When drying, it smells like new hay.

THE WILD MUSTARD

The wild mustard, or charlock, is a pretty sight for the tourist, but it is a great nuisance to the farmer. It covers his fields with a waving sheet of yellow blossoms that have to be uprooted by hand. The plant is covered with rough bristles.

THE SHEPHERD'S PURSE

This is a very common weed, and is to be found almost everywhere that man has gone. It is called shepherd's purse because the seed-vessel is like a little pouch, and shepherds used it as a charm that would save their sheep from wolves.

One of them, the Shepherd's Purse, with a rosette of narrow deeply lobed leaves and tiny white flowers, differs greatly from the much larger charlocks in the shape of its seed-pods. These are flat and heart-shaped, and split down the middle to set the seeds free. Old-fashioned purses were shaped like this and opened in a similar way, so we can easily guess how the plant got its name. These purses stand erect on their little footstalks. Its winter rosettes crowd out grass and clover, and a single plant will ripen fifty thousand seeds, so in spite of its small size it is to be dreaded in meadows as well as gardens.

THE CHARLOCK'S GOLDEN FLOWERS HATED BY THE FARMER

In May, and less abundantly in later months, we shall find ill-tended lands all golden with the bright yellow flowers of the Charlock, an annual of the Cross-bearing Family that is cordially disliked by the farmer. It is covered with rough bristles, and its leaves have their edges cut into bold teeth of several sizes. It has long slender seed-pods containing a single row of dark brown seeds. In some places it is known as wild mustard.

THE BINDWEED, A RELATIVE OF THE MORNING-GLORY

The pretty Bindweed is a pest that is very hard to kill, since it persists in an unbelievable manner, owing to the vitality of its fleshy rootstocks. It trails along the ground or winds up the grain-stalks. Its large brown seeds, like those of the cultivated morning-glory, in whose family it belongs, should be taken out of grain before it is sowed.

CHICKWEED AND CORN-COCKLE, TWO PERSISTENT WEEDS

In the Pink Family we have two very dissimilar plants. One is the humble and persistent Chickweed, whose tiny white flowers open during practically the whole year. The other is the tall Corn-cockle, with decoratively designed, pale magenta blossoms, with characteristic radiating lines on their heart-shaped petals and long pointed calyx-lobes that form a green star beneath the flower. It has slender-jointed hard round stems with narrow lance-shaped leaves in pairs; the whole plant is covered with white woolly hairs, even to the long points of the calyx.

Although the petals spread out so broadly that the flower may be as much as two inches across, we can see by pulling them out that they grow very slender at the base; they are called "claws." The flowers are self-fertilized, after allowing insects to visit them, by the elongation of the stamens until they come in contact with the several stigmas. The resulting fruit is a swollen capsule filled with little black seeds somewhat triangular in shape and bearing rows of teeth. These capsules are often discovered in grain and should be cast out, for they not only discolor the flour, but, being poisonous, render it unwholesome. Cheap, poor flour containing cockle-seeds, when fed to poultry or other animals, causes either a quick death or a lingering one.

THE BLACK NIGHTSHADE IS A DANGEROUS WEED

Among our poisonous plants we must not forget the Black Nightshade, another member of that dangerous Potato Family. It is a weak little herb, delighting in damp shady places, with wavy-edged ovate leaves, drooping clusters of small white flowers like those of the potato, and tempting juicy round black berries. It is poisonous in every part, even small browsing animals being affected, and is therefore a very bad thing for youngsters to nibble.

THE BITTER-TASTING TANSY

The Bitter-tasting Tansy, with its bunches of bright yellow, flat-topped little flower-heads and beautiful fern-like leaves, often stands by the roadside; and in dry fields we will find, shooting up, the long spears of tall mulleins, with soft yellow flowers, and plush-like leaves, so hoary and wide, which the English admire so that they cultivate our weed as a garden plant known as "velvet-leaf." The thickness of the leaf is a protection against the sun's rays, which are apt to be very strong in the exposed sites it chooses.

We have spoken of the rolled-up fruiting heads of wild carrots that carry seeds afield. There are certain other weeds that also dry up in the fall, and, either breaking away from their central taproots, or pulling them out of the dry soil, roll themselves into balls and are blown hither and yon across the open plains. Such are the dreaded Russian Thistles, which are very like the prickly saltwort of our beaches, and a related tumbleweed of the prairies. Both belong to the Goosefoot Family.

THE NEXT STORY OF PLANT LIFE IS ON PAGE 5601.

THE CORN-COCKLE

The rich crimson-purple flowers of the corn-cockle, measuring about two inches across, are conspicuous in grain-fields from June to September. The plant itself grows four or five feet high, and the stems, on which the flowers grow singly, are hairy.

THE FIELD CONVOLVULUS

It seems a pity that the pretty little field convolvulus, or bindweed, which is so common in our grain-fields and other cultivated ground, should be a dangerous pest to farmers and gardeners, strangling almost everything that it twines round as it climbs.

THE COMMON CHICKWEED

The chickweed flowers from spring to autumn; but it is an untidy plant. It thrives well in a garden, where we do not want it. Canaries are passionately fond of the seeds.

THE BLACK NIGHTSHADE

This is a dangerous plant to meddle with, for the green parts are poisonous and the purple-black berries are very injurious to children. The flowers are white.

THE OXEYE DAISY

This is one of the most showy members of the Chrysanthemum Family, the flowers being something like those of the Mayweed, but much larger. The oxeye daisy is a favorite with children, who string the flower-heads together.

THE YELLOW TOAD-FLAX

The flower of the toad-flax is in shape much like the snapdragon of our gardens, but, unlike that plant, it has a long spur projecting from its base. The deep yellow flowers are responsible for the name of butter-and-eggs often given to this plant.

THE WILD CARROT

This flower-head is formed of a large number of separate lacy white umbels. When the fruit succeeds the white blossoms the flower-heads become shaped like curious hollow cups, and are called bird's nests.

THE COMMON RAGWORT

This flower seems to grow everywhere, and blooms in the late summer and the autumn. Its golden stars produce many seeds, and the plant spreads very rapidly. It is a close relative of the groundsel, and an enemy of hay-fever victims.

ROADSIDE PLANTS AND WEEDS

1. Corn Marigold. 2. Corn Parsley (E.). 3. Corn Gromwell. 4. Common Corn Salad (Rare).
5. Bladder Campion. 6. Sun Spurge (E.). 7. Red Poppy (E.). 8. Heartsease. 9. Corn Chamomile.

Plants marked (E.) are European and are not generally found in America.

1. Corn Cockle. 2. Hare's Ear (E.). 3. Corn Mint. 4. Small Bur Parsley (E.). 5. Cornflower (E.). 6. Wild Chamomile. 7. Toothed Corn Salad (E.). 8. Field Bindweed. 9. Ivy-leaved Speedwell.

1. Corn Woundwort. 2. Blue Pimpernel. 3. Meadow Hawkbit. 4. Yellow Rattle. 5. Purple Cow-wheat (E.). 6. Pink Persicaria. 7. Small Snapdragon. 8. Red Hemp Nettle.

1. Scarlet Pimpernel. 2. Lady's Comb. 3. Sow Thistle. 4. Climbing Persicaria (E.). 5. Pheasant's Eye. 6. Field Madder (E.). 7. Yellow Chamomile. 8. Mouse Tail. 9. Field Scabious.

A STORY OF WHALING

HERMAN MELVILLE, the author of Moby Dick, was born in New York City in 1819. At eighteen years of age he went to sea as a cabin-boy on a vessel trading to Liverpool. Four years later he went for a whaling cruise in the Pacific. After enduring a year and a half of cruelty from his captain, Melville deserted at the Marquesas Islands. He was captured by cannibals, but was rescued by an Australian ship. So Melville knew well the life which he describes in Moby Dick, or The Whale. He combined scientific details and imaginative adventures in a dramatic tale which appeals greatly to all those who love the sea. Herman Melville wrote other books, but this is his best-known work. He died in 1891.

MOBY DICK, OR THE WHALE

ISHMAEL, the man who is supposed to tell this story, was a young American sailor. He had sailed on merchant ships for several trips, but some whim made him wish to go whaling. In the early part of the nineteenth century Nantucket was noted for the whaling ships which left its harbor. So thither Ishmael was bound. At New Bedford he found that the Nantucket packet had already sailed. There was nothing to do but to go to an inn and wait for the next boat. The only room he could find had to be shared with a stranger. Rather than sit up all night, Ishmael decided to share the room.

But the sight of his bedfellow, who arrived later, made his hair stand on end. The man was a South Sea Islander! The newcomer did not notice Ishmael in the bed, but proceeded to set up a little wooden idol and worship it. With his worship concluded, the black man lighted a pipe resembling a tomahawk and leaped into bed beside Ishmael. His surprise was as great as was the fear of the sailor. He waved his tomahawk pipe and threatened to kill Ishmael unless the white man explained the reason for his presence. Ishmael roared at the top of his lungs for the landlord. The owner of the inn appeared, and with a grin explained that Queequeg, the black man, would not hurt a hair of the white man's head. Ishmael found out also that Queequeg had been a cannibal. But in the days of waiting in New Bedford, Ishmael and Queequeg became fast and firm friends. The cannibal was a harpooner by profession, and he was looking for another whaling ship. So attached did he become to his white friend that he asked Ishmael to find a ship on which both would sail.

Ishmael made inquiries, and discovered that three whaling ships in the harbor were soon to set out on three-year cruises in the Pacific. He decided that one, the Pequod, would be the very ship for Queequeg and himself. At once he started to find the captain, but, instead, he found two retired captains and part owners of the Pequod in charge. The real commander, Captain Ahab, did not appear. He was signed on and also obtained a berth for Queequeg.

Captain Ahab did not appear until the Pequod was breasting the open seas, several days' journey from Nantucket. To Ishmael's surprise, the Captain was a one-legged man, wearing an ivory stump to replace the missing leg. Down his face ran a rod-like livid mark like a birthmark. But his look was that of a man suffering some mighty woe. He was moody in

the extreme, and rarely spoke even to the officers. The mates, Starbuck, Stubb and Flask, were white men from the vicinity of Cape Cod. The three harpooners were savages. Tashtego was an American Indian. Daggoo was a gigantic coal-black negro from Africa. Queequeg was the third harpooner. The other members of the crew were of varied nationalities: Holland, France, Iceland, Malta, Sicily, China, Tahiti, Portugal, Ireland and England were represented. It was indeed a motley crew that crowded the forecastle of the Pequod.

One afternoon Captain Ahab ordered the first mate, Starbuck, to send everybody aft. This was a startling move, but the mate obeyed. Ahab began by asking what the crew would do if a whale were seen. The answers pleased him. He became very much excited and drew a gold coin from his pocket. This he nailed to the mast, and said the coin would belong to the man who first sighted a white whale with a wrinkled brow and a crooked jaw. The three harpooners exclaimed at this. Tashtego asked if the whale meant was not called Moby Dick. His question threw Captain Ahab into a frenzy. He swore wildly that it was Moby Dick that had taken his leg. Half sobbing, half shouting, he told the crew that it was his intention to follow the White Whale until he killed it. His excitement spread to the men, who made a solemn promise to stick by Captain Ahab until his vengeance was complete. Starbuck made a protest which had no effect on the captain.

From his shipmates Ishmael learned that this White Whale was well known to members of the whaling fleets. It was noted for its color, size and ferocity. Many attempts had been made to capture it, but without success. Moby Dick, as it was nicknamed, stove in the pursuing small boats and killed or maimed some of the crews. The harpoons that had been thrown into its sides stuck there, but seemed to have no more effect than so many needles. Moby Dick was the largest whale known, and the most dangerous. There were captains who would change the course of their vessel rather than encounter this leviathan. So it was no wonder that Starbuck thought Captain Ahab was mad.

It was some days later that the look-out at the mast-head shouted in wild eagerness: "There she blows! There! there! there! she blows! she blows!" His words were the time-honored signal that a whale was spouting near at hand. Immediately great excitement prevailed, for it was the first time on this cruise that a whale had been sighted. Preparations were made to lower the boats when the crew's attention was attracted to Captain Ahab. He was standing by the spare boat, and at his side were five dusky strangers! From their appearance these men looked like natives of the Manillas. But Ahab gave the crew no time to wonder whence these strangers had come. The order to lower away was repeated, and the four boats were launched. But Starbuck whispered to Stubb that the Captain must have smuggled his odd companions on board at Nantucket, and ever since they had been secreted in the hold. Rowing their hardest, the men in Starbuck's boat drew alongside a sperm whale, and Queequeg threw his harpoon into the creature's hump. At that moment a squall struck the boat, which was swamped. The whale escaped, and the crew, managing to scramble back into their places, returned to the ship.

Whenever the Pequod came within hauling distance of another ship Ahab would ask if there was news of the White Whale, but usually there was not. The crew of the Pequod heard a wondrous tale of mutiny and an encounter with Moby Dick from the crew of the Town-Ho, but they did not tell Ahab.

Once a false alarm raised the whole ship. "The White Whale!" cried the look-out; but when the boats were launched the white patch on the sea proved to be the ghostly white giant squid. Stubb's boat was the first to land a sperm whale. When the blubber was stripped away, it was thought that one hundred barrels of sperm-oil would be obtained. Ishmael describes very fully exactly what happened from the moment a whale was sighted until the blubber was stowed away. There was a period of great danger when the boats of the Pequod came upon a school of whales. Starbuck's boat was almost caught between two charging monsters, but by a miracle it escaped. A piece of luck came to Stubb when he, by a trick, persuaded a French captain to cast off from a dead whale. In this whale was found some handfuls of the very precious ambergris.

Ahab asked his usual question when the ship Samuel Enderby of London came within hail. In answer the English captain lifted an artificial arm of white whalebone and said Moby Dick had been the cause of his loss. But that had happened the previous season. When he told Ahab that he had had enough of the White Whale, the captain of the Pequod left the English ship in such a hurry that he cracked his ivory leg. But the ship's carpenter made a new one.

The Pequod had arrived in the region which Moby Dick was known to frequent. In preparation for meeting his enemy Ahab ordered the blacksmith to forge a special harpoon, and gave his own razors to be used as edges for the barbs. An exceptionally stout hickory pole and a coil of new tow-line completed the weapon. At this time Ahab dreamed vividly of seeing hearses. But Fedallah, one of the five dark strangers, told the captain that his death would come by means of a rope. Fedallah said his own death would precede that of Ahab.

The long-awaited word of Moby Dick came from a large ship, the Rachel. Her captain said that an attempt had been made to capture the White Whale the day before, but the boat from which a harpoon had been thrown in Moby Dick had been dragged away at such speed that the Rachel lost sight of her. In that boat was the captain's son. Pitifully and desperately the Rachel's captain begged Ahab to join in the search for the missing boat; but Ahab had become almost a madman at the thought that Moby Dick was near, and he refused to aid the Rachel.

Ahab began to remain on deck all the day to look out for his enemy. He distrusted the keenness of the crew and wanted to have the first sight of Moby Dick. But before his wish was granted the Pequod met another ship, the Delight, which had just lost five men through the White Whale.

What happened when Moby Dick was first sighted by the Pequod is given in the words of the book.

THE WHITE WHALE IS SIGHTED

THAT night, in the mid-watch, when the old man—as his wont at intervals—stepped forth from the scuttle in which he leaned, and went to his pivot-hole, he suddenly thrust out his face fiercely, snuffing up the sea air as a sagacious ship's dog will, in drawing nigh to some barbarous isle. He declared that a whale must be near. Soon that peculiar odor, sometimes to a great distance given forth by the living sperm whale, was palpable to all the watch; nor was any mariner surprised when, after inspecting the compass, and then the dog-vane, and then ascertaining the precise bearing of the odor as nearly as possible, Ahab rapidly ordered the ship's course to be slightly altered, and the sail to be shortened.

The acute policy dictating these movements was sufficiently vindicated at daybreak, by the sight of a long sleek on the sea directly and lengthwise ahead, smooth as oil, and resembling in the pleated watery wrinkles bordering it, the polished metallic-like marks of some swift tide-rip, at the mouth of a deep, rapid stream.

"Man the mast-heads! Call all hands!" Thundering with the butts of three clubbed handspikes on the forecastle deck, Daggoo roused the sleepers with such judgment claps that they seemed to exhale from the scuttle, so instantaneously did they appear with their clothes in their hands.

"What d'ye see?" cried Ahab, flattening his face to the sky.

"Nothing, nothing, sir!" was the sound hailing down in reply.

"T'gallant sails!—stunsails! alow and aloft, and on both sides!"

All sail being set, he now cast loose the life-line, reserved for swaying him to the main royal-mast head; and in a few moments they were hoisting him thither, when, while but two-thirds of the way aloft, and while peering ahead through the horizontal vacancy between the main-top-sail and top-gallant-sail, he raised a gull-like cry in the air, "There she blows! —there she blows! A hump like a snow-hill! It is Moby Dick!"

Fired by the cry which seemed simultaneously taken up by the three look-outs, the men on deck rushed to the rigging to behold the famous whale they had so long been pursuing. Ahab had now gained his final perch, some feet above the other look-outs, Tashtego

standing just beneath him on the cap of the top-gallant-mast, so that the Indian's head was almost on a level with Ahab's heel. From this height the whale was now seen some mile or so ahead, at every roll of the sea revealing his high sparkling hump, and regularly jetting his silent spout into the air. To the credulous mariners it seemed the same silent spout they had so long ago beheld in the moonlit Atlantic and Indian Oceans.

"And did none of ye see it before?" cried Ahab, hailing the perched men all around him.

"I saw him almost that same instant, sir, that Captain Ahab did, and I cried out," said Tashtego.

"Not the same instant; not the same —no, the doubloon is mine, Fate reserved the doubloon for me. *I* only; none of ye could have raised the White Whale first. There she blows! there she blows!—there she blows! There again!—there again!" he cried, in long-drawn, lingering, methodic tones, attuned to the gradual prolongings of the whale's visible jets. "He's going to sound! In stunsails! Down top-gallant-sails! Stand by three boats. Mr. Starbuck, remember, stay on board, and keep the ship. Helm there! Luff, luff a point! So; steady, man, steady! There go flukes! No, no; only black water! All ready the boats there? Stand by, stand by! Lower me, Mr. Starbuck; lower, lower—quick, quicker!" and he slid through the air to the deck.

"He is heading straight to leeward, sir," cried Stubb, "right away from us; cannot have seen the ship yet."

"Be dumb, man! Stand by the braces! Hard down the helm!—brace up! Shiver her!—shiver her!—So; well that! Boats, boats!"

Soon all the boats but Starbuck's were dropped; all the boat-sails set—all the paddles plying; with rippling swiftness, shooting to leeward; and Ahab heading the onset. A pale, death-glimmer lit up Fedallah's sunken eyes; a hideous motion gnawed his mouth.

Like noiseless nautilus shells, their light prows sped through the sea; but only slowly they neared the foe. As they neared him, the ocean grew still more smooth; seemed drawing a carpet over its waves; seemed a noon-meadow, so serenely it spread. At length the breathless hunter came so nigh his seemingly unsuspecting prey, that his entire dazzling hump was distinctly visible, sliding along the sea as if an isolated thing, and continually set in a revolving ring of finest, fleecy, greenish foam. He saw the vast, involved wrinkles of the slightly projecting head beyond. Before it, far out on the soft Turkish-rugged waters, went the glistening white shadow from his broad, milky forehead, a musical rippling playfully accompanying the shade; and behind, the blue waters interchangeably flowed over into the moving valley of his steady wake; and on either hand bright bubbles arose and danced by his side. But these were broken again by the light toes of hundreds of gay fowls softly feathering the sea, alternate with their fitful flight; and like to some flagstaff rising from the painted hull of an argosy, the tall but shattered pole of a recent lance projected from the White Whale's back; and at intervals one of the cloud of soft-toed fowls hovering, and to and fro skimming like a canopy over the fish, silently perched and rocked on this pole, the long tail feathers streaming like pennons.

A gentle joyousness—a mighty mildness of repose in swiftness, invested the gliding whale. Not the white bull Jupiter swimming away with ravished Europa clinging to his graceful horns; his lovely, leering eyes sideways intent upon the maid; with smooth bewitching fleetness, rippling straight for the nuptial bower in Crete; not Jove, not that great majesty Supreme! did surpass the glorified White Whale as he so divinely swam.

On each soft side—coincident with the parted swell, that but once leaving him, then flowed so wide away—on each bright side, the whale shed off enticings. No wonder there had been some among the hunters who namelessly transported and allured by all this serenity, had ventured to assail it; but had fatally found that quietude but the vesture of tornadoes. Yet calm, enticing calm, oh, whale! thou glidest on, to all who for the first time eye thee, no matter how many in that same way thou may'st have bejuggled and destroyed before.

And thus, through the serene tranquillities of the tropical sea, among waves whose hand-clappings were suspended by exceeding rapture, Moby Dick moved on, still withholding from sight the full terrors of his submerged trunk, entirely hiding

the wrenched hideousness of his jaw. But soon the fore part of him slowly rose from the water; for an instant his whole marbleized body formed a high arch, like Virginia's Natural Bridge, and warningly waving his bannered flukes in the air, the grand god revealed himself, sounded, and went out of sight. Hoveringly halting, and dipping on the wing, the white sea-fowls longingly lingered over the agitated pool that he left.

With oars apeak, and paddles down, the sheets of their sails adrift, the three boats now stilly floated, awaiting Moby Dick's reappearance.

"An hour," said Ahab, standing rooted in his boat's stern; and he gazed beyond the whale's place, towards the dim blue spaces and wide wooing vacancies to leeward. It was only an instant; for again his eyes seemed whirling round in his head as he swept the watery circle. The breeze now freshened; the sea began to swell.

"The birds!—the birds!" cried Tashtego.

In long Indian file, as when herons take wing, the white birds were now all flying towards Ahab's boat; and when within a few yards began fluttering over the water there, wheeling round and round, with joyous, expectant cries. Their vision was keener than man's; Ahab could discover no sign in the sea. But suddenly as he peered down and down into its depths, he profoundly saw a white living spot no bigger than a white weasel, with wonderful celerity uprising, and magnifying as it rose, till it turned, and then there were plainly revealed two long crooked rows of white, glistening teeth, floating up from the undiscoverable bottom. It was Moby Dick's open mouth and scrolled jaw; his vast, shadowed bulk still half blending with the blue of the sea. The glittering mouth yawned beneath the boat like an open-doored marble tomb; and giving one sidelong sweep with his steering oar, Ahab whirled the craft aside from this tremendous apparition. Then, calling upon Fedallah to change places with him, went forward to the bows, and seizing Perth's harpoon, commanded his crew to grasp their oars and stand by to stern.

Now, by reason of this timely spinning round the boat upon its axis, its bow, by anticipation, was made to face the whale's head while yet under water. But as if perceiving this stratagem, Moby Dick, with that malicious intelligence ascribed to him, sidelingly transplanted himself, as it were, in an instant, shooting his pleated head lengthwise beneath the boat.

Through and through; through every plank and each rib, it thrilled for an instant, the whale obliquely lying on his back, in the manner of a biting shark, slowly and feelingly taking its bows full within his mouth, so that the long, narrow, scrolled lower jaw curled high up into the open air, and one of the teeth caught in a row-lock. The bluish pearl-white of the inside of the jaw was within six inches of Ahab's head, and reached higher than that. In this attitude the White Whale now shook the slight cedar as a mildly cruel cat her mouse. With unastonished eyes Fedallah gazed, and crossed his arms; but the tiger-yellow crew were tumbling over each other's heads to gain the uttermost stern.

And now, while both elastic gunwales were springing in and out, as the whale dallied with the doomed craft in this devilish way; and from his body being submerged beneath the boat, he could not be darted at from the bows, for the bows were almost inside of him, as it were; and while the other boats involuntarily paused, as before a quick crisis impossible to withstand, then it was that monomaniac Ahab, furious with this tantalizing vicinity of his foe, which placed him all alive and helpless in the very jaws he hated; frenzied with all this, he seized the long bone with his naked hands, and wildly strove to wrench it from its gripe. As now he thus vainly strove, the jaw slipped from him; the frail gunwales bent in, collapsed, and snapped, as both jaws, like an enormous shears, sliding further aft, bit the craft completely in twain, and locked themselves fast again in the sea, midway between the two floating wrecks. These floated aside, the broken ends drooping, the crew at the stern-wreck clinging to the gunwales, and striving to hold fast to the oars to lash them across.

At that preluding moment, ere the boat was yet snapped, Ahab, the first to perceive the whale's intent, by the crafty upraising of his head, a movement that loosed his hold for the time; at that moment his hand had made one final effort to push the boat out of the bite. But only slipping further into the whale's mouth, and tilting over sideways as it

slipped, the boat had shaken off his hold on the jaw; spilled him out of it, as he leaned to the push; and so he fell flat-faced upon the sea.

Ripplingly withdrawing from his prey, Moby Dick now lay at a little distance, vertically thrusting his oblong white head up and down in the billows; and at the same time slowly revolving his whole spindled body; so that when his vast wrinkled forehead rose—some twenty or more feet out of the water—the now rising swells, with all their confluent waves, dazzlingly broke against it; vindictively tossing their shivered spray still higher into the air. So, in a gale, the but half baffled Channel billows only recoil from the base of the Eddystone, triumphantly to overleap its summit with their scud.

But soon resuming his horizontal attitude, Moby Dick swam swiftly round and round the wrecked crew; sideways churning the water in his vengeful wake, as if lashing himself up to still another and more deadly assault. The sight of the splintered boat seemed to madden him, as the blood of grapes and mulberries cast before Antiochus's elephants in the book of Maccabees. Meanwhile Ahab half smothered in the foam of the whale's insolent tail, and too much of a cripple to swim,—though he could still keep afloat, even in the heart of such a whirlpool as that; helpless Ahab's head was seen, like a tossed bubble which the least chance shock might burst. From the boat's fragmentary stern, Fedallah incuriously and mildly eyed him; the clinging crew, at the other drifting end, could not succor him; more than enough was it for them to look to themselves. For so revolvingly appalling was the White Whale's aspect, and so planetarily swift the ever-contracting circles he made, that he seemed horizontally swooping upon them. And though the other boats, unharmed, still hovered hard by; still they dared not pull into the eddy to strike, lest that should be the signal for the instant destruction of the jeopardized castaways, Ahab and all; nor in that case could they themselves hope to escape. With straining eyes, then, they remained on the outer edge of the direful zone, whose centre had now become the old man's head.

Meantime, from the beginning all this had been descried from the ship's mastheads; and squaring her yards, she had borne down upon the scene; and was now so nigh, that Ahab in the water hailed her;—"Sail on the"—but that moment a breaking sea dashed on him from Moby Dick, and whelmed him for the time. But struggling out of it again, and chancing to rise on a towering crest, he shouted,—"Sail on the whale!—Drive him off!"

The Pequod's prows were pointed; and breaking up the charmed circle, she effectually parted the White Whale from his victim. As he sullenly swam off, the boats flew to the rescue.

Dragged into Stubb's boat with bloodshot, blinded eyes, the white brine caking in his wrinkles; the long tension of Ahab's bodily strength did crack, and helplessly he yielded to his body's doom for a time, lying all crushed in the bottom of Stubb's boat, like one trodden under foot of herds of elephants. Far inland, nameless wails came from him, as desolate sounds from out ravines.

But this intensity of his physical prostration did but so much the more abbreviate it. In an instant's compass, great hearts sometimes condense to one deep pang, the sum total of those shallow pains kindly diffused through feebler men's whole lives. And so, such hearts, though summary in each one suffering; still, if the gods decree it, in their lifetime aggregate a whole age of woe, wholly made up of instantaneous intensities; for even in their pointless centres, those noble natures contain the entire circumferences of inferior souls.

"The harpoon," said Ahab, half way rising, and draggingly leaning on one bended arm—"is it safe?"

"Aye, sir, for it was not darted; this is it," said Stubb, showing it.

"Lay it before me;—any missing men?"

"One, two, three, four, five;—there were five oars, sir, and here are five men."

"That's good.—Help me, man; I wish to stand. So, so, I see him! there! there! going to leeward still; what a leaping spout!—Hands off from me! The eternal sap runs up in Ahab's bones again! Set the sail; out oars; the helm!"

It is often the case that when a boat is stove, its crew, being picked up by another boat, help to work that second boat; and the chase is thus continued

with what is called double-banked oars. It was thus now. But the added power of the boat did not equal the added power of the whale, for he seemed to have treble-banked his every fin; swimming with a velocity which plainly showed, that if now, under these circumstances, pushed on, the chase would prove an indefinitely prolonged, if not a hopeless one; nor could any crew endure for so long a period, such an uninterrmitted, intense straining at the oar; a thing barely tolerable only in some one brief vicissitude. The ship itself, then, as it sometimes happens, offered the most promising intermediate means of overtaking the chase. Accordingly, the boats now made for her, and were soon swayed up to their cranes—the two parts of the wrecked boats having been previously secured by her—and then hoisting everything to her side, and stacking her canvas high up, and sideways outstretching it with stunsails, like the double-jointed wings of an albatross, the Pequod bore down in the leeward wake of Moby Dick. At the well known, methodic intervals, the whale's glittering spout was regularly announced from the manned mast-heads; and when he would be reported as just gone down, Ahab would take the time, and then pacing the deck, binnacle-watch in hand, so soon as the last second of the allotted hour expired, his voice was heard. —"Whose is the doubloon now? D'ye see him?" and if the reply was No, sir! straightway he commanded them to lift him to his perch. In this way the day wore on; Ahab, now aloft and motionless; anon, unrestingly pacing the planks.

As he was thus walking, uttering no sound, except to hail the men aloft, or to bid them hoist a sail still higher, or to spread one to a still greater breadth—thus to and fro pacing, beneath his slouched hat, at every turn he passed his own wrecked boat, which had been dropped upon the quarter-deck, and lay there reversed; broken bow to shattered stern. At last he paused before it; and as in an already over-clouded sky fresh troops of clouds will sometimes sail across, so over the old man's face there now stole some such added gloom as this.

Stubb saw him pause; and perhaps intending, not vainly, though, to evince his own unabated fortitude, and thus keep up a valiant place in his Captain's mind, he advanced, and eyeing the wreck exclaimed—"The thistle the ass refused; it pricked his mouth too keenly, sir, ha!"

"What soulless thing is this that laughs before a wreck? Man, man! did I not know thee brave as fearless fire (and as mechanical) I could swear thou wert a poltroon. Groan nor laugh should be heard before a wreck."

"Aye, sir," said Starbuck drawing near, " 'tis a solemn sight; an omen, and an ill one."

"Omen? omen?—the dictionary! If the gods think to speak outright to man, they will honorably speak outright; not shake their heads, and give an old wives' darkling hint.—Begone! Ye two are the opposite poles of one thing; Starbuck is Stubb reversed, and Stubb is Starbuck; and ye two are all mankind; and Ahab stands alone among the millions of the peopled earth, nor gods nor men his neighbors! Cold, cold—I shiver!—How now? Aloft there! D'ye see him? Sing out for every spout, though he spout ten times a second!"

The day was nearly done; only the hem of his golden robe was rustling. Soon it was almost dark, but the look-out men still remained unset.

"Can't see the spout now, sir;—too dark"—cried a voice from the air.

"How heading when last seen?"

"As before, sir,—straight to leeward."

"Good! he will travel slower now 'tis night. Down royals and top-gallant stunsails, Mr. Starbuck. We must not run over him before morning; he's making a passage now, and may heave-to a while. Helm there! keep her full before the wind!—Aloft! come down!—Mr. Stubb, send a fresh hand to the fore-mast head, and see it manned till morning."—Then advancing towards the doubloon in the main-mast—"Men, this gold is mine, for I earned it; but I shall let it abide here till the White Whale is dead; and then, whosoever of ye first raises him, upon the day he shall be killed, this gold is that man's; and if on that day I shall again raise him, then, ten times its sum shall be divided among all of ye! Away now! the deck is thine, sir."

And so saying, he placed himself half way within the scuttle, and slouching his hat, stood there till dawn, except when at intervals rousing himself to see how the night wore on.

At day-break, the three mast-heads were punctually manned afresh.

"D'ye see him?" cried Ahab, after allowing a little space for the light to spread.

"See nothing, sir."

"Turn up all hands and make sail! he travels faster than I thought for;—the top-gallant sails!—aye, they should have been kept on her all night. But no matter —'tis but resting for the rush."

Here be it said, that this pertinacious pursuit of one particular whale, continued through day into night, and through night into day, is a thing by no means unprecedented in the South sea fishery. For such is the wonderful skill, prescience of experience, and invincible confidence acquired by some great natural geniuses among the Nantucket commanders; that from the simple observation of a whale when last descried, they will, under certain given circumstances, pretty accurately foretell both the direction in which he will continue to swim for a time, while out of sight, as well as his probable rate of progression during that period. And, in these cases, somewhat as a pilot, when about losing sight of a coast, whose general trending he well knows, and which he desires shortly to return to again, but at some further point; like as this pilot stands by his compass, and takes the precise bearing of the cape at present visible, in order the more certainly to hit aright the remote, unseen headland, eventually to be visited: so does the fisherman, at his compass, with the whale; for after being chased, and diligently marked, through several hours of daylight, then, when night obscures the fish, the creature's future wake through the darkness is almost as established to the sagacious mind of the hunter, as the pilot's coast is to him. So that to this hunter's wondrous skill, the proverbial evanescence of a thing writ in water, a wake, is to all desired purposes well nigh as reliable as the steadfast land. And as the mighty iron Leviathan of the modern railway is so familiarly known in its every pace, that, with watches in their hands, men time his rate as doctors that of a baby's pulse; and lightly say of it, the up train or the down train will reach such or such a spot, at such or such an hour; even so, almost, there are occasions when these Nantucketers time that other Leviathan of the deep, according to the observed humor of his speed; and say to themselves, so many hours hence this whale will have gone two hundred miles, will have about reached this or that degree of latitude or longitude. But to render this acuteness at all successful in the end, the wind and the sea must be the whaleman's allies; for of what present avail to the becalmed or windbound mariner is the skill that assures him he is exactly ninety-three leagues and a quarter from his port?

. . . . . .

The rest of the story will be told in a condensed form.

On the second day of the chase three boats were lowered to pursue the White Whale. Moby Dick raised himself to the surface of the sea within a very short distance of the Pequod. But the whale did not wait to be pursued. He dashed the mates' boats together, then shooting under Captain Ahab's boat, threw it high into the air. Ahab's wooden leg was again shattered. On the third day nothing would discourage the Pequod's captain from continuing his attack.

When his boat neared the White Whale for the third time Ahab saw Fedallah's body enmeshed in the ropes of the harpoons sticking in the whale's sides. Moby Dick dived before a fresh harpoon could be hurled at him and swam away. Starbuck made another effort to persuade his Captain to quit the chase, but Ahab was beyond reason. He came up with the White Whale and viciously darted his fierce iron into his enemy. The giant creature writhed and shot forward. The tremendous strain snapped the harpoon rope. But in his rage Moby Dick sighted the Pequod herself and bore down upon the ship. The enormous bulk smote the ship's starboard bow till men and timbers reeled. The Pequod sprang a leak and began to sink. Moby Dick dived and came up near Ahab's boat.

Ahab, now absolutely mad, threw his harpoon. The whale dashed forward. As the harpoon rope ran out it fouled in its groove. Ahab stooped to clear it. The flying loop of line caught him round the neck and he was dragged out of the boat. The rope snapped at the boat and Captain Ahab disappeared, dragged under by Moby Dick. The small boat was caught in the suction as the Pequod went down to her ocean grave. And of all her crew Ishmael alone came to the surface, where he was picked up next day by the Rachel.

THE NEXT STORY OF FAMOUS BOOKS IS ON PAGE 5543.

The Spectacled Cobra.

The Egyptian Cobra.

The Malay Cobra.

The Ring Cobra.

THE EXTRAORDINARY SNAKES

MAN is much kinder to the animal world than formerly. There are many societies for the prevention of cruelty to animals, societies to preserve bird life, and the like. Thousands of men refuse to kill birds or four-footed animals for sport. Men give large sums of money to prevent the extinction of certain forms of animal life. The snakes, however, have few friends, and there is no outcry because snakes are growing fewer around the homes of men.

Perhaps some of this attitude comes from the lessons learned in childhood. In the Book of Genesis, toward the end of the story of Eden we find the following:

> And the Lord God said unto the serpent: Because thou hast done this thou art cursed above all cattle, and above every beast of the field; upon thy belly shalt thou go, and dust shalt thou eat all the days of thy life.
>
> I will put enmity between thee and the woman, and between thy seed and her seed; it shall bruise thy head, and thou shalt bruise his heel.

Apparently mankind has always done its utmost to bruise the head of the serpent, and some species have bruised our heel. The snakes, or some of them, do do us harm, but some of them do a great deal of good. They kill hosts of our enemies—rats, mice, wild pigs, small game of the jungles, and the too-numerous deer. They eat many insects and a few birds. On the other hand, every year the poisonous snakes in India destroy enough people to make a good-sized town.

It is often said that fear and dislike of snakes are born in us, but experience seems to show that this is untrue. Because of our early training we dislike them and cannot see their beauty and their grace. Perhaps it is just as well not to accept the company of a snake unless we are positive as to its species and character.

There are about seventeen hundred species of snakes distributed throughout the temperate and tropical regions of the world. They range in size from a tiny burrowing creature the size of a goose-quill, and only a few inches long, to the great Regal Python, nearly or fully thirty feet long, and weighing three hundred pounds. Some species are poisonous, but more are harmless to man. Some lay eggs, but others bring forth their young alive. Some live on land, others spend most of their time in trees, while others are found in water, salt or fresh. Some are quick and graceful, others slow and awkward. Some are dull in

appearance, while others exhibit bright colors.

Though the reproductive powers of snakes are generally high, they have many enemies and their numbers are not increasing in inhabited lands. A great python may lay nearly a hundred eggs, though not all of them will hatch. Some of the snakes which bring forth their young alive may produce fifty or more at a birth, but the number is usually smaller.

Besides man, who generally kills a snake at every opportunity, some birds are fond of snakes, and many animals, including the common pig, eat them. Some snakes feed on other snakes. The King Cobra will eat nothing else, and the King Snake destroys many of other species. Where religion or custom forbids killing snakes, as in some parts of India, they may become a real plague.

How a snake moves over the ground

Naturalists tell us that the ancestors of the snakes in the long ago had four limbs. They remain now as mere vestiges in certain of the boas. On the surface of the skin toward the rear part are a pair of claws; within are small bones, the whole forming the remains of a snake's departed hind legs.

Gliding through narrow ways, climbing trees, swimming in river, lake and sea, the snakes now have a different equipment. They have an enormous number of ribs—sometimes three hundred pairs—loosely united to the backbone. The free ends of the ribs are each attached to a shield of horn on the exterior of the skin beneath the body. It is by this plan that the snake moves. The ribs ripple forward, a pair at a time, and in doing so, thrust forward the rear edges of the shield to which they are united. At each movement the shield grips some rough spot on the ground, and so the whole body is drawn ahead.

The snakes that climb trees often have these under-shields placed in the form of a keel, and the arrangement enables them to glide rapidly up a tree. Some water snakes, not needing to make progress on land, have reduced under-shields. But be it land or water to which they are committed, no snake can raise itself into the upright loops which pictures often suggest; the formation of the backbone prevents it. The wriggling movement of the reptiles is always horizontal. This one fact disposes of the tales of great sea serpents which are always supposed to appear at the surface of the sea exposing great coils arranged in upward and downward loops. Snakes are not built that way.

The very little head through which a snake's big meal must pass

The food of snakes varies from eggs, insects, frogs, lizards and other snakes, to prey as great as human beings, large antelopes and goats. Yet the head of a snake, through part of which such a meal must pass whole, is comparatively small. The fact is that the lower jaw is not solid bone like ours; it is in halves, united at the chin by elastic ligaments. When a victim is seized the snake draws itself over the body like a glove being made to envelop a hand. The lower jaw moves forward in steps, one half at a time. The throat and gullet of the reptile are incredibly flexible. A snake nine feet long has been known to swallow another of its kind only a few inches less in size.

It is the non-poisonous species which make these mighty meals. The snakes with virus are all smaller and demand less food. How they developed this frightful poison is more than the wisest can say. Food which would feed a lion or a human hunter is converted in this creature's system into poison as deadly as those in the chemist's laboratory.

The venom lies in very muscular sacs in each side of the upper jaw, and in some species extends past the head down the sides of the fore part of the body. The teeth may be tubular, or they may be merely grooved. In either case there is a clear opening from the root of the tooth into the poison sac.

Generally speaking, especially in the more deadly serpents, when the mouth is closed, the poison fangs lie flat down in the jaw. When the mouth is opened to strike, the teeth rise into a perpendicular position, like the baleen in a whale's mouth.

The terrible poison which causes swift and painful death

The moment the fangs press on the flesh of a victim venom is forced by muscular action from the sacs through the hollow root of the tooth, down the channel and into the wound. The fluid may be actually harmless to the system

THREE DEADLY ENEMIES OF MAN

The Boa Constrictor.

The Horned Viper.

The terrible Anaconda lies in wait for its prey.

of the prey if taken into the stomach and acted on by the digestive juices; but introduced directly into the blood, it is rapidly distributed throughout the body. In some species it paralyzes the nerve centres, stopping the heart and breathing, and causing swift and painful death. In other species, such as our copperhead and rattlers, the poison breaks down the blood capillaries, causing internal hemorrhages and discolored swellings near the wound.

Snakes live long and grow continuously, and in order that they may do so, they cast their skins several times a year. They have no eyelids; the eyes are fixed within transparent scales which come away with the rest of the skin.

Excessive heat may cause some species to become torpid in summer; cold drives them into as deep a winter sleep as that of a hibernating dormouse. They can fast for months at a time, but they must drink if they are awake. Not even the sluggish snake can exist many months without moisture. Even the blind snakes drink—creatures of the underworld, sightless, toothless, harmless, living in burrows on ants and millipedes and the larvæ of insects.

A SNAKE THAT SOMETIMES GROWS TO BE THIRTY FEET LONG

These monsters have keen sight and great teeth in both upper and lower jaws, and have fronted life with audacity since long before man, in the warmer parts of Asia, Africa, America, Australia and the West Indies.

We do well to doubt unconfirmed reports of the size of wild things killed and measured in haste far from the aids to scientific accuracy; but it is well established that India and Malacca have a python thirty feet long, and that the great Anaconda, or Water Boa, of tropical America may reach nearly the same size.

No wonder these reptiles can crush deer, sheep and men. Appetites are naturally keener in the wilds than in a cage at a zoo; but even under unfavorable conditions a boa fourteen feet long ate four dead lambs, each between twelve and nineteen pounds in weight, and each having horns several inches long. That was a meal consumed within twenty-four hours, and sufficed for only ten days, when a fifth lamb was eaten. Another boa is said to have swallowed a goat weighing ninety-three pounds in an hour and a half; while a third, after eating a thirty-one-pound goat, swallowed a forty-three-pound deer the same day.

HOW THE GREAT SNAKE SWALLOWS THE BODY OF ITS VICTIM

The crushing of the body is caused not merely by the swallowing. When the animal is seized, the snake holds its head with its fangs, wraps its great coils round and round it, and squeezes with terrific force. Pressure is continued as long as any movement indicates that the prey is still alive.

In common speech all large snakes are sometimes called boa constrictors. It is true that they are constrictors and kill their prey by squeezing it, but the pythons and the boas are separate subfamilies, and the name Boa Constrictor properly belongs to only one of the boas, and that not the largest. This is the Common Boa of South America.

The pythons number many species, and Australasia and the East have some notable examples. The largest is the Regal, or Reticulated, Python of Southern Asia and the neighboring islands. The Indian, or Black-tailed, Python is smaller and can be tamed. This species is frequently shown by snake-charmers. Not all the pythons are large. Some are not more than six or eight feet long when full grown. Except one small species found in Mexico, all belong to the Old World. But we need not follow the group into species, merely noting that with varying size is varying habit. Some are haunters of rocks, some take to trees.

Pythons belong to the Old World, but boas are found in both hemispheres. Though some are small, the gigantic Anaconda of South America is a fearsome reptile. It swims superbly and spends much of its time on half-submerged logs. It may rest among the branches of a huge tree and reach down to pick up an unsuspecting peccary or a deer from the ground below. The Yellow Anaconda is somewhat smaller.

A THRILLING FIGHT BETWEEN A SNAKE AND A MAN IN A BOAT

Though not poisonous, the anaconda is one of the most terrible of living things: to it all animal life is simply a meal for the getting. A friend of the writer was attacked in a boat by one of these monsters, and lived to tell the tale as the most horrifying adventure in a career of many perils.

There are many other boas. The Common Boa (*Boa constrictor*) is seldom over eleven feet long. The Cuban Boa is about the same size and has a particularly vicious disposition. The Rainbow Boa shows gorgeous greens and violets in the sunlight. Then there are several species of tree boas which have long slender bodies and large heads. They spend nearly all their time in trees and are always bad-tempered.

The Sand Boas of Africa and Asia are generally short clumsy snakes which get their living by burrowing in the ground. They eat small mammals. In America a close ally is the Rubber Boa, which may be found as far north as Oregon.

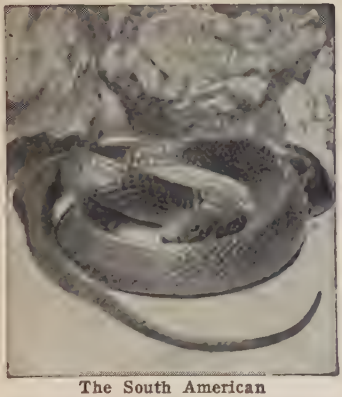
The most common American snakes are the Striped, or Garter, Snakes, of which there are many species, and in the species the color often varies. Since a female may give birth to as many as seventy-five little ones, it is no wonder that they are common. They live upon earthworms, small fish, tadpoles, frogs and toads, and seldom are more than three feet long. The Common Garter Snake of our gardens is entirely harmless and should never be killed.

Next we may mention the racers, found in both hemispheres. The American Black Snake is found from the Atlantic to the Pacific. It is graceful and swift, and is not only harmless to man, but does much good by eating rats and mice and the young of other snakes, though it

The Water Moccasin.

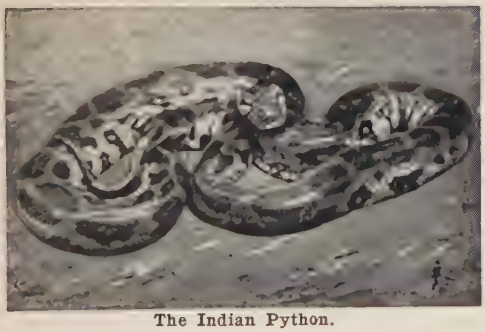
The Viper, or Adder.

The dark green snake of South Europe.

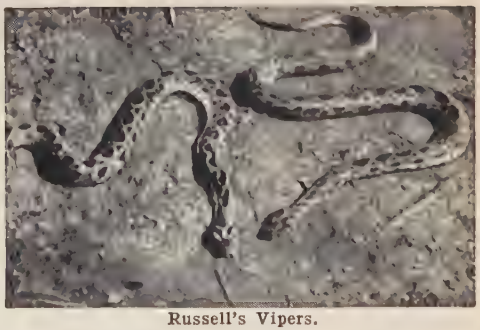


The South American Corais Snake.

The American Garter Snake.



The Indian Python.

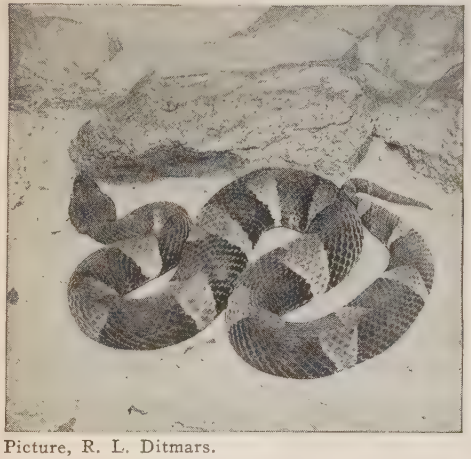


Russell's Vipers.

The pictures on these pages are by Messrs. W. G. Berridge, S. Crook, C. R. Walter, and others.

does not object to young birds. Closely allied are the Coach-whip and the Gopher Snakes. Their habits and their food are much the same.

The Pilot Snake is believed by the superstitious to warn the rattlesnake of the approach of danger. It is harmless, and so is the Chicken Snake, which eats many rats and mice to one chicken. The Hog-nosed Snake is hideously ugly and is often called the Puff Adder, but it, too, is harmless, and lives on frogs and toads. The King Snake is a handsome cannibal which attacks any other snake it meets, no matter if poisonous, and, if bitten, seems to suffer little harm. It is gentle toward man and makes an interesting pet. The stories that the Milk



Picture, R. L. Ditmars.

The Copperhead, closely related to the rattlesnake, gets its name from its copper-colored head. It is found only in North America.

Snake steals milk from the cows are fables.

A CANNIBAL MEMBER OF THE GREAT FAMILY OF SNAKES

So far we have not described any of the poisonous snakes, and now we come to the cobras, with their striking hoods, ten species in all, confined to Africa and Southern Asia with the adjacent islands. Six feet may seem small for a typical cobra, but it is the deadliest six feet in the world. The Spectacled Cobra, or Cobra-de-capello, of India is the most striking. It is the most vicious of all snakes. And, as we must have giants, here we have them in the King Cobra, or Hamadryas—twelve feet or more of it, and not wholly evil, for it gorges on other snakes as it can catch them. The Egyptian Cobra, or Asp, is smaller but equally deadly. They are all dangerous, capable of killing the healthiest man in half an hour if their poison is introduced into a blood-vessel. Australia's Death Adder is a villain in the same tragic cast.

It is bad enough to be poisoned by contact, but an African cobra, the Ringhals, can injure at a distance. It has the power of squirting out venom and striking an object several feet away. This cannot kill, but the fluid is said to cause temporary injury to the eyes, and the reptiles have a gift of marvelous accuracy in reaching the eye of a man or an animal at which they aim.

Closely allied to the cobras is a group of snakes of which the deadly Krait of Southern Asia is a representative. The nearest relatives of these snakes in the New World are the Coral Snakes, of which two species are found in the United States and the other twenty-four in Mexico, Central and South America. They are generally marked with red, black and yellow, and closely resemble some harmless species.

We come to the sea snakes. Of great sea serpents, the last is believed to have died many, many years ago, but there are comparatively small sea snakes which can kill a man swimming in the sea and are deadly to fish and other marine life. The virulence of their poison varies with the species, but it has been found that some species have a poison as deadly as some of the cobras.

THE GREAT FAMILY OF DEADLY VIPERS

Like the water snakes, the vipers, with one or two exceptions, produce their young alive. They may be divided into two subfamilies: the True Vipers, which are confined to the Old World; and the Pit Vipers, so called because they have a deep pit between the eye and the nostril on each side of the head. The pit vipers include our more important venomous snakes, though some species live in the Old World.

There are ten species of the true vipers. The Common Viper of Europe is the only venomous snake in the British Isles, where it is often called an adder. Its bite causes illness, but seldom death except in the nervous and highly sensitive. Other species are: the Cape Viper of South Africa; the Tic Polonga, or Russell's Viper, one of the most deadly serpents of India; the Puff Adder of

THE DEADLY RATTLESNAKE

This is a Western Diamond Rattlesnake basking in the sunlight. From the number of rattles in its tail we can tell that it is not six years old, and may be younger. Rattlesnakes belong to the Viper Family, and their bite is deadly. If not irritated, however, they seldom strike.

The rattlesnake is peculiarly an American snake. Many species are found in North America, and they vary in color. These snakes hibernate, and as cold weather comes on they gather in large numbers and sleep the winter through in a cave. This picture shows Timber Rattlesnakes.

Photo by R. L. Ditmars, courtesy American Museum of Natural History.

Africa and Arabia; the Rhinoceros Viper, the Horned Viper and, the ugliest of all, the Gaboon Viper of Africa. Some think that the horned viper is the snake that caused the death of Cleopatra.

THE DEADLY PIT VIPERS OF THE NEW WORLD

There are four genera and about seventy species of these pit vipers. The purpose or the use of these pits we do not know, but the bone is hollowed out on each side of the head, and a large nerve leads to the pit, and its presence is a warning to us to let the snake which possesses it severely alone.

First we may mention the Water Moccasin, or Cotton-mouth, of the South. This snake may grow to be six feet long, and is one of the deadliest as well as the ugliest of American snakes. It eats fishes, frogs, other snakes, small animals —anything it can get. There is a smaller species in Mexico and Central America. Closely akin is the Copperhead, a smaller upland snake, sometimes called the Highland Moccasin. Its reddish brown color gives the name. It is found from New England southward east of the Mississippi, and also in Texas.

The next group includes two of the deadliest of New World serpents. The Bushmaster of Central and South America may reach a length of twelve feet, but is rather slender. It is reddish yellow in color, with black bands. It lays eggs instead of bringing forth young alive. Another horror is the deadly Fer-de-lance (lance-head) of Central and South America and the West Indies. It is greenish gray in color, with dark bands, and is hardly more than six feet long. The Palm Viper is sometimes brought to the North in cargoes of bananas.

THE UNIQUE RATTLESNAKES OF THE WESTERN HEMISPHERE

The rattlesnakes are divided into two genera and from eighteen to twenty species. One species is found in South America, but Mexico and southern United States are the home of the great majority, though a few species are found as far north as southern Canada. Though they differ much in size and color, they all are distinguished by the "rattle."

When born, the baby rattler has no rattle, but merely a "button." Each time the skin is shed the tip of the old skin remains attached to the end of the tail. It is the rustling of one of these tips over the adjacent one which makes the characteristic sound. There is a popular belief that each rattle represents a year of age. This is not true. The rattlesnake may shed its skin oftener than once a year, and, on the other hand, some of the rattles may be broken and lost.

The largest and most venomous is the Diamond-back of southeastern United States. It grows to be eight feet long, but is the heaviest of poisonous serpents. The Texas, or Western Diamond, Rattlesnake ranges from Texas to California. It is paler than the eastern species, and not quite so large. Another snake of the arid regions is the Horned Rattlesnake, or Sidewinder, so called from its motion. It has a horn above each eye, and is yellowish or pinkish with darker markings. It is seldom more than three feet long. The common rattlesnake of the East is the Timber, or Banded, Rattlesnake. It may be entirely black or yellow and black. It prefers rocky hills and ledges, and in some regions is quite common. In winter dozens, or even hundreds sometimes, gather in crevices in the rocks and pass the winter days in company. When warm days come they crawl out to bask in the sun.

The Pacific Rattlesnake is found in the West from British Columbia south to Utah. It is yellowish brown and black, and is rarely much over three feet long. Occasionally black specimens are found. The Prairie Rattlesnake is found in the plains region. It is about the same size and color as the Pacific species.

Other rattlesnakes are the Pigmy Rattlesnake of southeastern United States, gray in color, marked with black on the back. It is not more than eighteen or twenty inches long, and the rattle is correspondingly small, but it is a true rattlesnake, though its bite is seldom fatal. A larger species, the Massasauga, is found in the centre of the continent. The South American Rattlesnake is also found in Mexico and Central America.

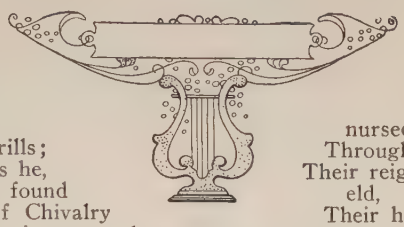
We have now finished our survey of the snakes. It is well to remember that we have but four poisonous snakes in North America, if we count the rattlesnakes as one. These are the rattlesnake and the copperhead in the North, and in addition to these the South has the coral snake and the water moccasin. So, on the whole we are fortunate.

THE NEXT STORY OF ANIMAL LIFE IS ON PAGE 5453.

A POEM OF PATRIOTISM

THIS poem by Charles Sangster (1822–93), a Canadian writer and journalist, strikes a high note of patriotism. The eyes of Canadians are on the future rather than on the past, and to the work of building a great nation in a great land their energies are chiefly directed. Appreciation of their country and belief in its future distinguish Canadian poetry of the present. Though the early days are remembered with tender sympathy, Canadians believe that "the best is yet to be."

OUR NORLAND



WE have no Dryads in our woods,
No Fairies in the hills,
No Nereids in the crystal floods,
Nor Undines in the rills;
No jolly Satyrs such as he,
The gentle Spenser, found
In that rare Dream of Chivalry
With which his muse is crowned:

No sacred Fawns, no Druid oaks,
No Sylvan deities,
No Ouphs to hold along the brooks
Their midnight revelries;
No Ogres, guarding castle-keeps,
No Witches wild and lean,
No crafty Sirens from the deeps,
No Genii from the green:

No mellow-throated nightingales
Rousing the wilds with song,
While Echo waits through all the vales
The sweet notes to prolong;
No larks, at heaven's coral gate,
To celebrate the day
In fiery strains, and passionate
Outbursts of lyric lay.

But we have birds of plumage bright,
And warblers in our woods,
Whose hearts are well-springs of delight,
Whose haunts, the solitudes—
The dim, untrodden wilderness,
Where wildness reigns supreme—
God's solemn temple none the less
Than some romantic dream;

Vast ev'n beyond the thought of man,
Magnificently grand;
Coeval with the first great plan
From Nature's artist-hand:
Deep within deep, and wild on wild,
In savage roughness rolled,
Grandeur on grandeur heaped and piled
Through lusty days of old:

The stern-browed cape, the lofty peak
Round which the mists are curled,
Whence Fancy not in vain might seek
The circle of the world:
Broad inland seas and lovely lakes
Their tributes seaward pour
O'er cataracts, whose thunder shakes
The granite-belted shore:

The rugged oak, the regal pine,
Our woodland monarchs, these,
Whose strong arms nursed the circling vine
Through countless centuries;
Their reign was from the days of eld,
Their hosts were mighty peers,
Who fought and fell as time compelled
The battle of the years.

We have no feudal castles old,
Like eyries perched on high,
Whence issue knights or barons bold,
To ravage and destroy;
But we've the remnant of a race
As bold and brave as they,
Whether in battle or the chase—
The Red Man of to-day.

How brave—how great—in days of yore,
Their scanty legends tell;
The soul a-hungered craves for more,
But lo! beneath the swell
Of Time's resistless, onward roll,
The unwritten secrets lie,
No voice from out the distant goal,
No answer but a sigh.

For Time, like some old miser, keeps
The record of the Tribes,
And will not yield it from the deeps
For promises or bribes.
What mighty Chiefs! what Sachems gray!
What multitudes of Braves!
But what remains of those to-day?
A continent of graves!

And in their stead the Old World pours
Its streams of living men—
Its hearts of oak, along our shores
To people hill and glen;
To battle through a nation's youth
Until, by heaven's grace,
We rise, in freedom and in truth,
Another British race.

Stand up, then, in thy youthful pride,
O nation yet to be,
And wed this great land to its bride,
The broad Atlantic Sea;
Fling out Britannia's flag above
Our heaven-born endeavour,
Our chain of waves, one chain of love,
Uniting us for ever.

JACQUES CARTIER

The celebrated French navigator Jacques Cartier was the first European to explore the waters of Canada. He spent a winter there and gave Mount Royal and the Bay of St. Lawrence their names. Thomas D'Arcy McGee, an Irish-Canadian poet, here gives us a picture of Cartier's departure on his second voyage and safe return.

IN the seaport of St. Malo, 'twas a smiling morn in May,
When the Commodore Jacques Cartier to the westward sailed away;
In the crowded old Cathedral all the town were on their knees,
For the safe return of kinsmen from the undiscovered seas;
And every autumn blast that swept o'er pinnacle and pier,
Filled manly hearts with sorrow, and gentle hearts with fear.

A year passed o'er St. Malo—again came round the day
When the Commodore Jacques Cartier to the westward sailed away;
But no tidings from the absent had come the way they went,
And tearful were the vigils that many a maiden spent;
And manly hearts were filled with gloom, and gentle hearts with fear,
When no tidings came from Cartier at the closing of the year.

But the earth is as the future, it hath its hidden side,
And the Captain of St. Malo was rejoicing in his pride;
In the forests of the North—while his townsmen mourned his loss—
He was rearing on Mount Royal the *fleur-de-lis* and cross;
And when two months were over, and added to the year,
St. Malo hailed him home again, cheer answering to cheer.

He told them of a region, hard, iron-bound, and cold,
Nor seas of pearl abounded, nor mines of shining gold;
Where the wind from Thulé freezes the word upon the lip,
And the ice in Spring comes sailing athwart the early ship;
He told them of the frozen scene, until they thrilled with fear,
And piled fresh fuel on the hearth to make them better cheer.

But when he changed the strain—he told how soon are cast,
In early Spring, the fetters that hold the waters fast;
How the wintry causeway, broken, is drifted out to sea,
And the rills and rivers sing with pride the anthem of the free;
How the magic wand of Summer clad the landscape to his eyes,
Like the dry bones of the just when they wake in Paradise.

He told them of the Algonquin braves—the hunters of the wild;
Of how the Indian mother in the forest rocks her child;
Of how, poor souls! they fancy in every living thing
A spirit good or evil, that claims their worshipping;
Of how they brought their sick and maimed for him to breathe upon;
And of the wonders wrought for them, through the Gospel of St. John.

He told them of the river whose mighty current gave
Its freshness for a hundred leagues to Ocean's briny wave;
He told them of the glorious scene presented to his sight,
What time he reared the cross and crown on Hochelaga's height;
And of the fortress cliff that keeps of Canada the key;—
And they welcomed back Jacques Cartier from his perils o'er the sea.

WHEN SUMMER COMES*

This poem by a Canadian author, John E. Logan (Barry Dane), is not strong, but has a certain haunting sweetness and melody, which is difficult to define.

WHEN summer comes,
Ah, so we longing sigh,
When winter winds are nigh,
When summer comes;
Our pulses like the rill
That now lies cold and still
Beneath the snow,
Will joyous flow
When summer comes.

When summer comes,
A messenger will bring
New life to everything,
When summer comes;
And unto you and me
Now parted, there may be
A moment sweet,
What time we meet,
When summer comes.

When summer comes,
Ah, the sweet, longed-for day
May be, yet pass away,
When summer comes;
And our sad feet have missed
The long expected tryst—
What shall we know
Of joy or woe
When summer comes?

When summer comes,
Alas, our hearts may yearn
For winter to return,
When summer comes;
The future we forecast,
We dream its joys shall last,
To-day is fraught
With but one thought
When summer comes.

*By permission of the author.

THE UNNAMED LAKE *

Reverend Frederick George Scott, clergyman, writer and poet, is the author of this little masterpiece.

IT sleeps among the thousand hills
Where no man ever trod,
And only Nature's music fills
The silences of God.

Great mountains tower above its shore,
Green rushes fringe its brim,
And o'er its breast for evermore
The wanton breezes skim.

Dark clouds that intercept the sun
Go there in spring to weep,
And there, when autumn days are done,
White mists lie down to sleep.

Sunrise and sunset crown with gold
The peaks of ageless stone,
Where winds have thundered from of old
And storms have set their throne.

No echoes of the world afar
Disturb it night or day,
But sun and shadow, moon and star,
Pass and repass for aye.

'Twas in the grey of early dawn,
When first the lake we spied,
And fragments of a cloud were drawn
Half down the mountain side.

Along the shore a heron flew,
And from a speck on high,
That hovered in the deepening blue,
We heard the fish-hawk's cry.

Among the cloud-capped solitudes,
No sound the silence broke,
Save when, in whispers down the woods,
The guardian mountains spoke.

Through tangled brush and dewy brake,
Returning whence we came,
We passed in silence, and the lake
We left without a name.

A CANADIAN BOAT-SONG

Thomas Moore, the famous writer of Irish melodies, is the author of this charming boat-song. Listen to the distant song of the rapids, and note the sense of danger suggested by the changing metre of the refrain.

FAINTLY as tolls the evening chime
Our voices keep tune and our oars keep time.
Soon as the woods on shore look dim,
We'll sing at St. Anne's our parting hymn.
Row, brothers, row, the stream runs fast,
The rapids are near, and the daylight's past.

Why should we yet our sail unfurl?
There is not a breath the blue wave to curl,
But, when the wind blows off the shore,
Oh, sweetly we'll rest our weary oar.
Blow, breezes, blow, the stream runs fast,
The rapids are near, and the daylight's past.

Utawas' tide! this trembling moon
Shall see us float over thy surges soon.
Saint of this green isle! hear our prayers,
Oh, grant us cool heavens and favoring airs.
Blow, breezes, blow, the stream runs fast,
The rapids are near, and the daylight's past.

*By permission of the author.

THE SONG MY PADDLE SINGS †

E. Pauline Johnson, daughter of Chief Johnson of the Mohawk Indians of Canada, wrote this beautiful poem, set to the rhythm of the paddle of a canoe.

WEST wind, blow from your prairie nest,
Blow from the mountains, blow from the west.
The sail is idle, the sailor too;
O wind of the west, we wait for you.
Blow, blow!
I have wooed you so,
But never a favor you bestow;
You rock your cradle the hills between,
But scorn to notice my white lateen.

I stow the sail and unship the mast:
I wooed you long, but my wooing's past;
My paddle will lull you into rest:
O drowsy wind of the drowsy west,
Sleep, sleep!
By your mountains steep,
Or down where the prairie grasses sweep,
Now fold in slumber your laggard wings,
For soft is the song my paddle sings.

August is laughing across the sky,
Laughing while paddle, canoe, and I
Drift, drift,
Where the hills uplift
On either side of the current swift.
The river rolls in its rocky bed,
My paddle is plying its way ahead,
Dip, dip,
When the waters flip
In foam as over their breast we slip.

And oh, the river runs swifter now;
The eddies circle about my bow:
Swirl, swirl!
How the ripples curl
In many a dangerous pool awhirl!
And forward far the rapids roar,
Fretting their margin for evermore;
Dash, dash;
With a mighty crash,
They seethe and boil, and bound and splash.

Be strong, O paddle! be brave, canoe!
The reckless waves you must plunge into.
Reel, reel,
On your trembling keel,
But never a fear my craft will feel.

We've raced the rapids, we're far ahead:
The river slips through its silent bed.
Sway, sway,
As the bubbles spray
And fall in tinkling tunes away.

And up on the hills against the sky,
A fir-tree rocking its lullaby
Swings, swings,
Its emerald wings,
Swelling the song that my paddle sings.

† By permission of L. A. Makovski, Executor.

THE WALKER OF THE SNOW

Charles Dawson Shanley gives great vividness to an old legend of the haunted valley and the Shadow Hunter.

SPEED on, speed on, good Master!
The camp lies far away;
We must cross the haunted valley
Before the close of day.

How the snow-blight came upon me
I will tell you as I go,—
The blight of the Shadow Hunter,
Who walks the midnight snow.

To the cold December heaven
Came the pale moon and the stars,
As the yellow sun was sinking
Behind the purple bars.

The snow was deeply drifted
Upon the ridges drear,
That lay for miles around me
And the camp for which we steer.

'Twas silent on the hillside,
And by the solemn wood,
No sound of life or motion
To break the solitude,

Save the wailing of the moose-bird
With a plaintive note and low,
And the skating of the red leaf
Upon the frozen snow.

And said I, "Though dark is falling,
And far the camp must be,
Yet my heart it would be lightsome
If I had but company."

And then I sang and shouted,
Keeping measure, as I sped,
To the harp-twang of the snow-shoe
As it sprang beneath my tread.

Not far into the valley
Had I dipped upon my way,
When a dusky figure joined me
In a capuchon of gray,

Bending upon the snow-shoes,
With a long and limber stride;
And I hailed the dusky stranger
As we travelled side by side.

But no token of communion
Gave he by word or look,
And the fear-chill fell upon me
At the crossing of the brook.

For I saw by the sickly moonlight
As I followed, bending low,
That the walking of the stranger
Left no footmarks on the snow.

Then the fear-chill gathered o'er me,
Like a shroud around me cast,
As I sank upon the snow-drift
Where the Shadow Hunter passed.

And the other trappers found me,
Before the break of day,
With my dark hair blanched and whitened
As the snow in which I lay.

But they spoke not as they raised me;
For they knew that in the night
I had seen the Shadow Hunter,
And had withered in his blight.

Sancta Maria speed us!
The sun is falling low,—
Before us lies the valley
Of the Walker of the Snow!

THE RED RIVER VOYAGEUR*

Pioneer days in Canada were full of dangers and difficulties. The poet Whittier pictures the boatman on the Red River listening to the far-away sound of the Mission bells that speak to him of peace and protection.

OUT and in the river is winding
The links of its long, red chain,
Through belts of dusky pine land
And gusty leagues of plain.

Only, at times, a smoke-wreath
With the drifting cloud-rack joins—
The smoke of the hunting-lodges
Of the wild Assiniboins!

Drearily blows the north wind
From the land of ice and snow;
The eyes that look are weary,
And heavy the hands that row.

And with one foot on the water,
And one upon the shore,
The Angel of Shadow gives warning
That day shall be no more.

Is it the clang of wild geese?
Is it the Indian's yell,
That lends to the voice of the north wind
The tones of a far-off bell?

The voyageur smiles as he listens
To the sound that grows apace;
Well he knows the vesper ringing
Of the bells of St. Boniface.

The bells of the Roman Mission,
That call from their turrets twain,
To the boatman on the river,
To the hunter on the plain!

Even so in our mortal journey
The bitter north winds blow,
And thus upon life's Red River,
Our hearts, as oarsmen, row.

And when the Angel of Shadow
Rests his feet on wave and shore,
And our eyes grow dim with watching,
And our hearts faint at the oar,

Happy is he who heareth
The signal of his release
In the bells of the Holy City,
The chimes of eternal peace!

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THE MOUNTED POLICE *

Robert W. Service celebrates in this poem the bravest body of men on the continent. Dauntless and daring, the Royal Canadian Police are the right arm of the law and the terror of the evil-doer.

IN the little Crimson Manual it's written plain and clear,
That who would wear the scarlet coat shall say good-bye to fear;
Shall be a guardian of the right, a sleuth-hound of the trail—
In the little Crimson Manual there's no such word as "fail."
It's duty, duty, first and last, the Crimson Manual saith;
The Scarlet Rider makes reply: "It's duty—to the death."
And so they sweep the solitudes, free men of all the earth;
And so they sentinel the woods, the wilds that know their worth;
And so they scour the startled plains, and mock at hurt and pain,
And read their Crimson Manual, and find their duty plain.
Knights of the lists of unrenown, born of the frontier's need,
Disdainful of the spoken word, exultant in the deed;
Unconscious heroes of the waste, proud players of the game;
Props of the power behind the throne, upholders of the name;
For thus the Great White Chief hath said, "In all my lands be peace,"
And to maintain his word he gave his West the Scarlet Police.

HARVEST TIME †

That wonderful hush of fruition which comes to the fields which are fully ripe, and before the gathering of the harvest, is well described in this poem by E. Pauline Johnson, who was born in 1862 and died in 1913.

PILLOWED and hushed on the silent plain,
Wrapped in her mantle of golden grain,

Wearied of pleasuring weeks away,
Summer is lying asleep to-day,—

Where winds come sweet from the wild-rose briers
And the smoke of the far-off prairie fires.

Purple her eyes as the mists that dream
At the edge of some laggard sun-drowned stream,

But over their depths the lashes sweep,
For Summer is lying to-day asleep.

The north wind kisses her rosy mouth,
His rival frowns in the far-off south

And comes caressing her sunburnt cheek,
And Summer awakes for one short week;

Awakes and gathers her wealth of grain,
Then sleeps and dreams for a year again.

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THE RAPID

This poem by Charles Sangster, the Canadian poet, is full of the dash and danger of the rushing rapid.

ALL peacefully gliding,
The waters dividing,
The indolent batteau moved slowly along;
The rowers light-hearted,
From sorrow long parted,
Beguiled the dull moments with laughter and song:
"Hurrah for the Rapid! that merrily, merrily
Gambols and leaps on its tortuous way;
Soon we will enter it, cheerily, cheerily,
Pleased with its freshness, and wet with its spray."

More swiftly careering,
The wild Rapid nearing,
They dash down the stream like a terrified steed;
The surges delight them,
No terrors affright them,
Their voices keep pace with their quickening speed:
"Hurrah for the Rapid! that merrily, merrily
Shivers its arrows against us in play;
Now we have entered it, cheerily, cheerily,
Our spirits as light as its feathery spray."

Fast downwards they're dashing,
Each fearless eye flashing,
Though danger awaits them on every side;
Yon rock—see it frowning!
They strike—they are drowning!
But downward they speed with the merciless tide:
No voice cheers the Rapid, that angrily, angrily
Shivers their bark in its maddening play;
Gaily they entered it—heedlessly, recklessly
Mingling their lives with its treacherous spray!

SONG OF THE GOLDEN SEA ‡

This Song, by Jean Blewett, the author of The Cornflower and Other Poems, brings a beautiful picture before the eye of the great harvest fields of Canada.

SING, ye ripening fields of wheat,
Sing to the breezes passing by,
Sing your jubilant song and sweet,
Sing to the earth, the air, the sky!

Earth that held thee and skies that kissed
Morning and noon and night for long,
Sun and rain and dew and mist,
All that has made you glad and strong!

The harvest fields of the far, far west
Stretch out a shimmering sea of gold!
Every ripple upon its breast
Sings peace, and plenty, and wealth untold!

Far as the eye can reach it goes,
Farther yet, 'til there seems no end,
Under a sky where blue and rose
With the gold and turquoise softly blend.

Here, where sweep the prairies lone,
Broad and beautiful in God's eyes,
Here in this young land, all our own,
The garner-house of the old world lies.

‡ By permission of the author.

MARCH

This and the following three poems are from a charming sequence of twelve, "A Canadian Calendar," by John Murray Gibbon, who after wide travel is resident in Canada—a writer of distinction, and the first president of the Canadian Authors' Association.

OUR gentle alchemist, the sun,
Dissolves each snowfield to a silvery lagoon.

Sweet-running maple sap!
You sing of frosty night and balmy day,
And sweet is the wind
That brings the robin to our North
To chug-chug with his mate
Over a new home in bare branches.

So our hearts, too,
Must dare a new adventure.

MAY

DAWN of pearl and of mist
From the amethyst—
Morning stained with rays
Of chrysoprase—
Midday veiled with gauze
Spun from turquoise—
Afternoon sapphire
Skies to admire—
Eve a chalice full,
Crystal cool—
And, as a moonstone, light
With dim lustre, Night.

OCTOBER

FALLING, falling leaves!
And indoors
Cellars sweet-smelling with apples,
Fair hands busy with canning and stores for the winter.

Morning in frosty apron,
Noon in a bonnet of blue,
Night with a cool dark cloak overtaking the day.

Once in a while a sky a-swirl with rain
And winds in wild cavalcades,
But always,
On the greensward,
Falling, falling leaves!

DECEMBER

THERE is a window in a quiet room
Over an orchard now of apples bare
Though in September no more sweet perfume
Filled any wind with a more fragrant air.

And in that silence through the window-bars
Through the deep azure that pervades the sky
Prick'd only by innumerable stars
I see a world of phantom passers-by.

I see the fairies of a winter's night
Float from the tree-tops to the path below
And pattern laces with the clear moon-light
And shadows of the branches on the snow.

And where the icicles hang from the eaves
Dropping their crystal pillars to the ground
I see the throne that only he achieves
Who wins a queen by all the fairies crowned.

Was that a sleigh bell or a magic note
Played in a dream to hearts that understand?
Surely I hear there with the dancers float
The clash of cymbals in an elfin band.

HEPATICAS

A song by Archibald Lampman, Canada's beloved poet, whose verse is published by William Briggs of Toronto.

THE trees to their innermost marrow
Are touched by the sun;
The robin is here and the sparrow:
Spring is begun!

The sleep and the silence are over:
These petals that rise
Are the eyelids of earth that uncover
Her numberless eyes.

FOR JUSTICE

This poem, commemorating the Canadians who fell at Langemarck, is by Bernard Freeman Trotter, a young hero of Canada who gave his life in France, dying in action on May 7, 1917.

OH, to have died that day at Langemarck!
In one fierce moment to have paid it all—
The debt of life to Earth, and Hell, and Heaven!
To have perished nobly in a noble cause!
Untarnished, unpolluted, undismayed
By the dank world's corruption, to have passed,
A flaming beacon-light to gods and men!
For in the years to come it shall be told
How these laid down their lives, not for their homes,
Their orchards, fields, and cities: "They were driven
To slaughter by no tyrant's lust for power;
Of their free manhood's choice they crossed the sea
To save a stricken people from its foe.
They died for Justice—Justice owes them this:
That what they died for be not overthrown."

WHO DIES IF ENGLAND LIVE?

This short poem by Rudyard Kipling is a stirring call to duty.

THOUGH all we made depart,
The old commandments stand:
In patience keep your heart!
In strength lift up your hand!

No easy hope or lies
Shall bring us to our goal—
But iron sacrifice
Of body, will, and soul.

There's but one task for all,
For each one life to give:
Who stands if Freedom fall?
Who dies if England live?

Boiling a kettle of liquid air on a block of ice.

An egg boiled in liquid air that cannot be broken.

HOT THINGS AND COLD THINGS

WE know that matter may exist in a solid, liquid or gaseous state, and we know that, as a general rule, what we call heat makes a great difference in this respect. We take water and make it cold, and if we go on making it cold long enough it becomes solid. If we begin with this solid water, or ice, and add heat to it, it becomes liquid. We might say, then, that liquid water is ice plus heat, that is to say, ice with heat added. If now we add more heat to this liquid water, or, in short, if we boil it, it all disappears, and we know that it has gone into the air as water-vapor, or gaseous water.

So we can go farther and say that water-vapor is liquid water plus heat, just as liquid water is ice plus heat. If that sounds reasonable, we are on the way to understanding what heat is, and as it is heat that we now have to study, we cannot do better than get this notion of heat as something added to matter, something that, as a rule, when added, makes the difference between the different states of matter.

Now, the all-important question about which men have argued for ages is the question as to what this something is. We are fortunate enough nowadays to be able to come in at the end of the argument and get the result without the trouble of working it out. There is in heat a something that is undoubtedly real. We know there is nothing unreal about the heat of a red-hot poker. But is it a kind of matter? Is it a thing that could be weighed? Or, if not, what is it?

In the first place, it is possible to make certain that heat is not a thing which can be weighed. A hot thing is no heavier than it was when it was cold. But every kind of matter has weight, because gravity acts on every kind of matter. Therefore, heat is not a kind of matter. But it is certainly something, and in our own day we have learned what this thing really is that cannot be weighed. It is motion.

Motion cannot be weighed; it cannot be handled or tasted, but it is very real, as we know. We know, too, that there are many kinds of motion, and of course it does not do to say that heat is motion unless we add that it is a very special and particular kind of motion, quite distinct from any other. We believe that heat is a special to-and-fro motion, which we have learned

to call "vibration," of the atoms or molecules of which matter is made.

Let us consider a simple case like that of water. Let us imagine that we have liquid water before us; it may be cold or hot water, but, in any case, it has a certain amount of heat in it; in other words, its molecules are vibrating at a certain rate and, we may suppose, with a particular length of vibration.

THE SWINGING OF THE MOLECULES THAT MAKES WATER HOT

If we add heat to this water, we are adding to it—on our motion of what heat really is—more motion of this particular kind. When the molecules of the water get this extra motion added to them, perhaps taking the form of a quicker motion, or perhaps taking the form of a longer swing, or perhaps both, the time comes when it is simply impossible for the molecules to swing so freely or so quickly, and yet to hold together in the way that makes liquid water. With so much heat in it the water has to become gas, other things being equal, and it does so. It boils. This water-vapor, as it now is, may have still more heat added to it, and we are unable to say what limits there are in this direction.

But now let us travel in the other direction. Instead of adding heat, which is a special kind of motion, to the water, let us begin to take from it the heat that it already has. We know that when we cool the water, in course of time it turns solid. Other things being equal—and we have to say this because the question of the pressure of the atmosphere really comes into this too—the molecules of the water can no longer be related in the way that makes the water liquid, if we take away from them too much of that particular kind of motion which we call heat. Deprived of much of this motion, the molecules have to arrange themselves in a different way so that we have ice.

ICE THAT CAN BE COOLED AND ICE THAT CAN BE HEATED

Now, though we all agree that liquid water may be hotter or colder, because we notice this every day, perhaps we are not all quite sure that ice may be hotter or colder; yet it certainly may. We can cool the ice as we cooled the water, and all the time we are taking away from it this particular kind of motion called heat; and so we may go on and on steadily lessening its heat up to a certain point.

Now, if a man has a certain amount of money, it may be added to, and there is no particular point at which no more can be added, and so it is with the addition of heat to anything. But if we start taking away a man's money, say, at the rate of one cent after another, the time is bound to come—and bound to come whether he started with a cent or with a million dollars—when he has no more money to lose, and, whatever we do to him, we cannot make him lose any more.

Now, what is true of money is true of anything else, such as the kind of motion we call heat. As we cool the ice we are taking this motion away from it, but the amount of it that the ice has is not infinite, and in course of time, if we go on steadily—though this may be tremendously difficult or impossible—we shall take away all the heat that was in the ice, and when that happens we shall have something which is absolutely cold.

There is now no heat in the ice; the utmost part of the kind of motion we call heat has left it. So far as that kind of motion is concerned, its molecules and atoms are still; they cannot be colder. If heat is such as we suppose, this must be a possibility for matter of all kinds, whether ice or anything else.

THE LOWEST TEMPERATURE TO WHICH MATTER CAN BE REDUCED

Further, it is possible to find out how cold a thing would have to be so that it could be no colder, and we do indeed know what that point is compared with our ordinary scales of temperature, about which we have already learned something. In various ways it has been shown that 273 degrees below the zero on the Centigrade scale is absolute cold. This means, on the thermometers we generally use, over 459 degrees below zero. Matter reduced to that point would have no heat in it.

First, let us consider the matter of measurement, always so important. We now have something better to go by even than the freezing-point and the boiling-point of water; we have something even better than the freezing-point of any substance that we know. We have discovered the existence of a point at which the motion that we call heat has ceased to exist.

Plainly, that point must be nothing, or zero, on the best possible scale of temperature. So, while there is a zero on

the Centigrade scale, and on various other scales, we now have discovered the *real zero*, where heat and temperature really begin; and this we call the *absolute zero*.

How the size of a thing is affected by its heat

Any student of heat, going to lectures or reading textbooks, will find such phrases as 10° absolute. The ordinary clumsy way of expressing that point on the scale would be —263° Centigrade, and, of course, we can see at once what a great advantage it is to reckon on the new scale. It is a great find for science to have discovered Nature's zero of temperature instead of having to fix on some point far above that real zero, and then to call that point the zero because we know no better.

The next question is this, What is matter like at absolute zero? We have taken a gas, such as water-vapor or hydrogen, the molecules of which are moving about in a particular way which we call heat. We have steadily taken away that motion; the gas has steadily become colder, first liquid and then solid. When we have taken away all the motion of this kind, what will be left? We must remember that the substance has steadily shrunk all the time; indeed, the greater part of its size to begin with, was due to the heat in it. If now, as we cool it, its size begins to lessen, is it not possible that when we have made it absolutely cold there may be nothing left of it?

Why we believe that matter does not disappear at absolute zero

It has been found that when a gas is cooled, for every degree Centigrade that the temperature is lowered it loses one 273d of its volume at 0 degrees Centigrade. Therefore at —273°, that is, at absolute zero, the gas would theoretically have lost 273-273ds, or the whole, of its volume, and cease to exist at all. It was at one time believed that this would happen, but now all known gases have changed into the liquid form at low temperatures. When they do so the law referred to, which is known as Gay-Lussac's law, after its author's name, does not hold good, as it is a law for gases only. We now believe that, even at absolute zero, matter would not disappear; in other words, heat is not matter.

It is believed by astronomers that in the mighty tracts of space between the stars and planets there are quantities of matter, such as is often called *cosmic dust*. Now, students of heat are convinced that in these great spaces the temperature must be practically that of the absolute zero, the coldest possible cold. Therefore, the existence of this temperature does not mean that matter disappears altogether. We have also the evidence provided by our own little attempts on the earth to reach the absolute zero.

The marvel of liquid air that can be poured out like water

It is not difficult to make carbon dioxid solid, and then it looks like a sort of snow. After all, snow itself is only solid water-vapor, and the two cases are parallel. It is more difficult, but still it is possible, to take the mixture of gases which we call air, and first to make it liquid by cooling, and then by cooling that liquid still more to make it become solid.

Much work on this subject has been done by Sir James Dewar, at the Royal Institution in London, and by Dr. Onnes at the University of Leyden in Holland. Liquid air is colder than ice, and it looks like water. It can be stored quite easily in vessels, and poured about just like water. A few drops running over our fingers would do them no harm, because the round drops would bound off and not actually *touch* the skin; but, of course, we should not put our fingers in it, and the consequences of drinking it are too terrible to think about.

The use of liquid air is one of the most convenient ways of making low temperatures—that is to say, for making other things cold—and it is now very largely used in chemistry for this purpose. Of course, liquid air is always very much colder than anything round about it. This means that the kind of motion called heat is pouring into it from outside, and, as this happens, the liquid air evaporates and turns into ordinary gaseous air again.

A piece of solid air that can be seen

No one could tell by looking at it that liquid air was not water, and when it is frozen no one could tell it from ice by looking at it. Solid air is, of course, very much colder than liquid air, but it is very far from reaching the lowest temperatures.

By the use of liquid air, and with the aid of very strong and expensive ma-

chinery, it is possible to liquefy all the gases that are known. It was a great triumph when hydrogen, the lightest of all the gases, was liquefied; and from liquid hydrogen there can be obtained for a few seconds solid hydrogen. Success has also been obtained by Dr. Onnes even with the gas helium, which had resisted all previous attempts.

Now, the question is, How low down in the scale do we get with such gases as these? The answer is that in the last few years steady progress has been made, and, instead of having to be content with, say, 14° or 12° absolute, we have got down to as low as within four-fifths of a degree of absolute zero. At first it sounds as if the great goal which all chemists desire will soon be attained. Dr. Onnes himself does not believe that we shall ever get lower than seven-tenths of a degree absolute. It may, indeed, he says, take years to get even one-hundredth of a degree lower.

THE DIFFICULTY OF GETTING ALL THE HEAT OUT OF A THING

In the first place, though one-hundredth of a degree is not much in our ordinary way of thinking, yet that partly depends on the way in which our minds are deceived by figures. If we chose a much finer reckoning, and divided every degree into a thousand degrees, then the interval between solid helium or hydrogen and the absolute zero would sound much larger.

Then, again, it is a fact that the farther we go the slower we go. We might suppose that to travel from 12° absolute to 8° would be just the same as to travel from 8° to 4° or from 4° to zero; but that is not true. Every degree lower is much harder to conquer than the one reached before.

One interesting and important discovery which we make when we study low temperatures is that the ordinary processes of chemistry are greatly changed. It seems, indeed, that many ordinary chemical processes, such as happen when a fire is burning, or such as those which are always going on in our own bodies, can occur only within a certain range of temperature. It is believed, for instance, that at the temperature of the sun things are too hot for most chemical processes to occur, and that few compounds are formed.

When we descend, instead of ascending, the same result is, in general, true. Just as chemical processes cease at high temperatures, so most of them cease at very low temperatures. Elements which ordinarily combine with great force, and perhaps explosive violence, do nothing at all when put together at very low temperatures. Nevertheless, there is also a low-temperature chemistry.

THE WAYS IN WHICH HEAT TRAVELS FROM PLACE TO PLACE

Let us now pass on to another interesting question: how heat travels or spreads from place to place. It travels by means of radiations, which agitate the ether, and this can be thrown into waves of different shapes and sizes, but all of the same speed —186,000 miles a second. Some of the waves convey light, some heat. The heat from the sun and from incandescent and hot, dark bodies, travels in such waves, and this method of heat transmission is called *radiation.*

Heat also travels by what we call *convection,* from the Latin word for "carrying." Let us take the case of the water in a kettle which is being heated. We can imagine the special kind of motion called heat being imparted to the molecules of water that lie nearest the bottom of the kettle. It may then be, as indeed it is, that these molecules rise to the surface of the water, and as they rise, of course they carry with them their heat. Now the heat which was applied to the under-surface of the water has reached its upper surface. It has been bodily carried, so to speak, through the water; and when heat is carried from place to place in this way, we say that this is a case of convection.

We may think of this, perhaps, if we care to, as like the case of a buzzing insect. The buzzing and humming are due to the vibration of its wings, and as it flies about it carries the buzzing and humming with it. So we may think of the molecules of matter as buzzing. That buzzing is their heat, and when they travel they carry it with them.

HOW THE WATER IN THE KETTLE BECOMES HEATED ALL THROUGH

In the case of the water in the kettle, the heated water rises. It does this because heated water is lighter than cold water. Therefore, by heating one part of the body of the water we can set the whole body of the water moving, and this applies not only to the kettle, but also to the oceans. It applies equally to other

fluids, such as the atmosphere. In all the water of the earth, and in the earth's great coat of air, different parts are at different times heated more or less than other parts, and so convection currents are started.

The results are very important, not only because heat is carried about from place to place, but because the matter carrying the heat is also moving about. In this way great ocean currents, and also great air currents, which we call winds, are started. There are constantly going on, for instance, what are called the trade-winds, so called because in the old days when ships were driven by the wind the ocean trade of the world largely depended on them. The whole subject of winds depends upon this fact. The air on some part of the earth's surface absorbs heat and becomes lighter, as we have learned. It rises, and the cooler air from the surrounding country rushes toward this region, and we have what we call a wind.

How a Row of Boys Can Show the Ways in Which Heat Travels

Heat travels also by what we call *conduction*. The conduction of heat occurs in all circumstances, in solids, liquids and gases, from solids to liquids, from gases to solids, and so on. It is the constant law, true everywhere and always, that whenever one thing is hotter than another, heat will flow from the hotter to the colder. Just as we say that water must find its own level because of the constant action of gravitation, so we may compare heat with water, and say that it must find its own level. The constant tendency of heat everywhere is to make its level equal. Every portion of matter everywhere which is hotter than its surroundings must lose heat to them, just as a river must run downhill.

Now, we must first understand what conduction actually is, and how it differs from convection. In conduction, the heat is passed on, or conducted, but the matter which contained it stays where it was. It is like a row of boys in which each one is slapping the next; whereas, in convection, the boys would change places and take their slaps with them. If we remember what heat is, we can begin to imagine how the buzzing, or vibration, of the atoms at one end of a poker might start the atoms farther along vibrating also in the same way, and so the buzzing, or heat, would be conducted along the poker. It is not possible to go more deeply into the nature of conduction than this, because we really do not know how the atoms or molecules of matter are held together in a poker, or in anything else. But we can study conduction in many ways, and the first thing we find is that different kinds of matter vary in their power of conducting heat.

The Living Tissues Which Are Bad Conductors of Heat

Everyone knows that one end of the poker becomes hot when the other end is held to the fire. Yet one end of a piece of firewood may be so hot as to be actually burning and the other end will be quite cool, though the stick is far shorter than the poker. The metals in general are good conductors of heat, as the iron of the poker suggests. On the other hand, tissues made by living things are very bad conductors of heat. Wood is such a tissue, though we do not always think of it as if it were, and we have noticed how badly it conducts heat. Bone, also, and wool and silk, and even linen and cotton tissues always conduct heat very badly indeed.

You know, though you may not have realized that you know, that things vary very much in their power to conduct heat. In a bedroom in which the windows have been open during a winter's night everything is about equally cold. Yet you have noticed how much colder the floor seems than the rug, and the water pitcher seems colder than either. In other words, wood is a better conductor of heat than wool, and earthenware is better than either. It is because wool conducts heat so poorly that we use it for garments in winter.

Though we rank the group of the metals as good conductors, yet even among themselves they vary a great deal. Those which conduct heat best are those which conduct electricity best—for instance, copper, silver, gold and aluminium. Iron is rather poor.

While every substance conducts electricity more or less, some are so much poorer conductors than others that they are called non-conductors, or insulators. While glass, mica and other minerals are poor conductors, or good insulators, it is to be noted that the materials made by living things are generally poor conductors also. Rubber, silk and gutta-percha are very poor conductors of electricity.

THE NEXT STORY OF THE EARTH IS ON PAGE 5569.

Not far from Spokane, in the state of Washington, is the King Lake Dam for the generation of electric power. Water reaches the power-house through the four great pipes you see in the picture. The quantity of water available is so great that you can see much going to waste over the dam. Photo, Asahel Curtis.

Where the Tugalo and the Chattooga rivers come together in northern Georgia the Tugalo dam has been built. Some of the water has already been used four times, and there is another dam three miles below. In this view of Tugalo by night we see above the gleaming windows of the power-house the lights on the roadway along the top of the dam. Photo, courtesy Georgia Railway and Power Company.

Courtesy Tennessee Electric Power Co.

Hales Bar Waterpower and Steampower Plants on the Tennessee River.

WATER POWER OF THE WORLD

FROM very earliest times men have made rivers work for them. Water-wheels, great and small, were built over streams so that the rushing water would strike the flat blades of the wheels and turn them. Wheat was ground into flour and logs were sawed into planks by using the mechanical power from these old water-wheels, which may be called the first water turbines. In China to-day are found great water-wheels little changed from those used a thousand years ago. In England, Norway, the United States and Canada we may still see, on small rivers in out-of-the-way places, water-wheels used to run sawmills and flour-mills.

When life was comparatively simple and manufacturing plants were few, primitive water power and power produced by coal were sufficient to supply the demand for power. When manufacturing increased and coal from mines became dear, men began to look about for a substitute. This they found in falling or rushing water, which afforded a means of obtaining an inexhaustible and cheap supply of power. From the foaming white surface of the swift water used, this source of power came to be called "white coal."

The use of white coal in producing electrical power is made possible by means of electric motors and dynamos. In the larger generating plants the water from the rushing stream is directed into great steel tubes, or penstocks, which lead it to a lower level and to the turbines. Electric dynamos change the rotation of the turbines into electricity. The power plants around the Niagara Falls have the largest turbines in the world, some of which develop 45,000 horse power.

Describing a water turbine in simple language, we may say that it is a wheel with buckets, or vanes, into which water is directed, and a case carrying nozzles to direct the flow. The water rushing through the nozzles strikes the vanes at an effective angle, driving them round and round. The wheel to which they are attached turns, too, and of course the wheel-shaft is also rotated. This acts as the rotor for the dynamo to which it is attached.

There is a simpler type of turbine called an impulse turbine, or Pelton wheel, to the rim of which cup-shaped buckets are fastened. Against these buckets water is shot with great force from a fine-jet nozzle, and the wheel is thereby caused to revolve rapidly.

This type of turbine is used where the water available has a light pressure.

It is really only since the beginning of the twentieth century that water power has become a very valuable natural resource. But now in every civilized country engineers are building plants to increase the use of white coal instead of black. All over the world the water turbine is altering industrial conditions. Countries that lack coal-mines but have water power can compete in the field of manufacturing.

Engineers say that all the water power of the world, if used, would amount to 439,000,000 horse power, but less than one-sixteenth of it has been harnessed.

Niagara Falls is the king of all water-power projects. Taking the development on Canadian and American sides, more generating stations operated by water are to be found there than in any other equal space in the world. The drop in the Niagara River, within a distance of a few miles, is 330 feet, of which 159 is the straight drop of the Falls. It is said that the Niagara River could produce 8,000,000 horse power, but at present this amount is not necessary. The country-side within many miles of the Falls is supplied with electric current at a very cheap rate. Syracuse, which is 150 miles away, gets its power from Niagara.

In the United States, if all available water-power resources were used, 35,000,000 horse power could be produced, but at present only 8,000,000 horse power is developed. Among the most important power plants in the United States are those on the Pacific coast. Power from Snoqualmie Falls in the state of Washington is transmitted eighty-three miles and serves both Seattle and Tacoma. Water power from the high Sierras is brought a distance of 154 miles to provide electric light and power for San Francisco and the cities around. At Holyoke, Massachusetts, power for the mills is developed from the Connecticut River. One of the most celebrated plants in the world is that at Keokuk, Iowa, on the Mississippi River, where the Des Moines rapids are utilized.

Canada benefits more than does the United States from the Niagara Falls, as she uses three times as much power generated on the Canadian side. But every province in Canada has some water-power resources. The Grand Falls on the Hamilton River in northeastern Canada are the highest falls in the world. In British Columbia the Takkakaw Falls are the fifth highest in the world. Between the two are rivers and lakes innumerable which now produce white coal or can be harnessed when they are needed.

In South America, Rio de Janeiro, with a population of 1,000,000, is supplied with light and power from a plant on the Lages River, fifty miles distant. Chile, too, has several power installations, and it is with these that she intends to electrify her railways. Brazil has the greatest water-power resources of the South American countries and has been the most progressive in developing them.

Sweden, Norway, France and Spain are the European countries which can look forward with confidence to an industrial period depending on cheap power. Norway and Sweden have come forward in competition for iron-ore-smelting markets. They had the iron but no coal when all cheap power was obtained from coal. Now they have cheap power from their waterfalls, so they are smelting the iron within their own boundaries.

France and Switzerland have doubled the horse power developed within their borders since 1915, and Spain has increased her use of water power sixfold. At Lake Fully, Canton Valais, Switzerland, is one of the most noted of the Swiss plants. Italy has done much with her water power in late years.

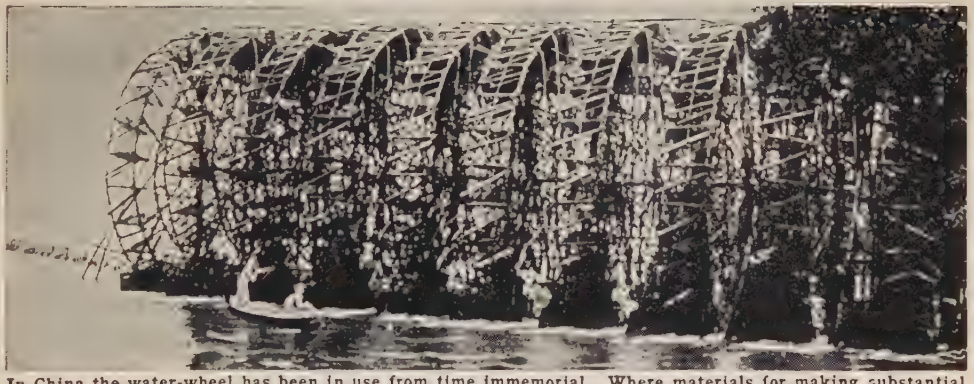
Africa is the richest of all the continents in water-power possibilities, for her rivers and falls could produce 190,000,000 horse power, of which, at present, only 11,000 is developed. In Asia, Japan is the country that has been most progressive in using white coal, and she is using one-sixth of her resources; China, on the other hand, has not waked to her opportunities, and there is practically no electric current produced from water power. New Zealand, Sumatra, Java and Tasmania are the countries of Oceania that are using water power to take the place of coal.

No one can prophesy what effect the use of water power will have on the trade of the world. Some people think that industrial centres will shift from coal-owning countries to water-power-owning countries.

THE NEXT STORY OF FAMILIAR THINGS IS ON PAGE 5575.

OLD-FASHIONED WATER-WHEELS

From very early times man has utilized water power by means of mechanical contrivances, and the water-wheel driven by a running stream is thousands of years old. Here is an old device seen in Devonshire.



In China the water-wheel has been in use from time immemorial. Where materials for making substantial wheels have been lacking, ingenious devices have been used. This huge water-wheel in French Indo-China is made of bamboo.

Norway, which has more available power than any other country in Europe, is erecting some large modern power stations, but for centuries she has used water power, in a primitive way, as seen at these sawmills by the side of a stream.

WATER PRESSURE TURNED INTO POWER

Water transmits its pressure practically undiminished, because it is nearly incompressible. Under high pressure it acts like a solid rod of steel, and it is used for driving rivets into iron and steel

Hydraulic cranes are largely used in the coaling of vessels. They are worked by water conveyed under high pressure in strong pipes. Hundreds of lifts are also worked by water power, including barge-lifts.

A MOTOR WORKED BY THE OCEAN WAVES

The plant shown in this picture is a wave-power pumping station on the California coast. A huge float in a concrete pit on the edge of the cliff rises and falls with the waves and works the pump.

Water power is used more and more in mining, where the metal-bearing gravel is at the surface. A powerful jet of water directed on the gravel detaches it and washes it into a sluice.

NIAGARA'S VAST SUPPLIES OF POWER

Niagara is a striking example of water power running to waste for centuries. Now more and more of the water of the famous river is being harnessed for the purpose of providing cheap electricity.

This is one of the great power houses at Niagara. It is estimated that the total water power of the world that might be harnessed for use is equal to 439,000,000 horse power, of which about 25,000,000 is already used.

A RIVER IMPRISONED IN PIPES

When a river is harnessed it must be imprisoned in pipes and brought to the turbines, as it is done at Kinlochleven, Argyllshire.

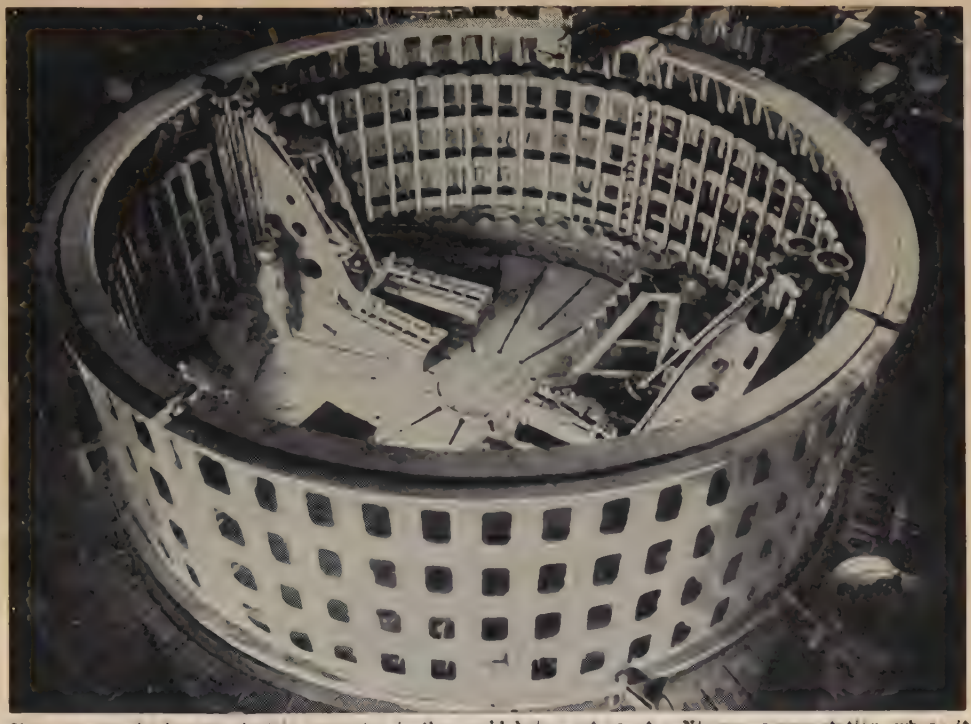
Sometimes, instead of a river, a lake is harnessed, and this picture shows the immense power station at Lake Coleridge, South Island, New Zealand.

The pipes that carry the water are of great strength and size, as can be seen here, and each line supplies a different turbine. The water can be regulated and directed away from the turbine if necessary.

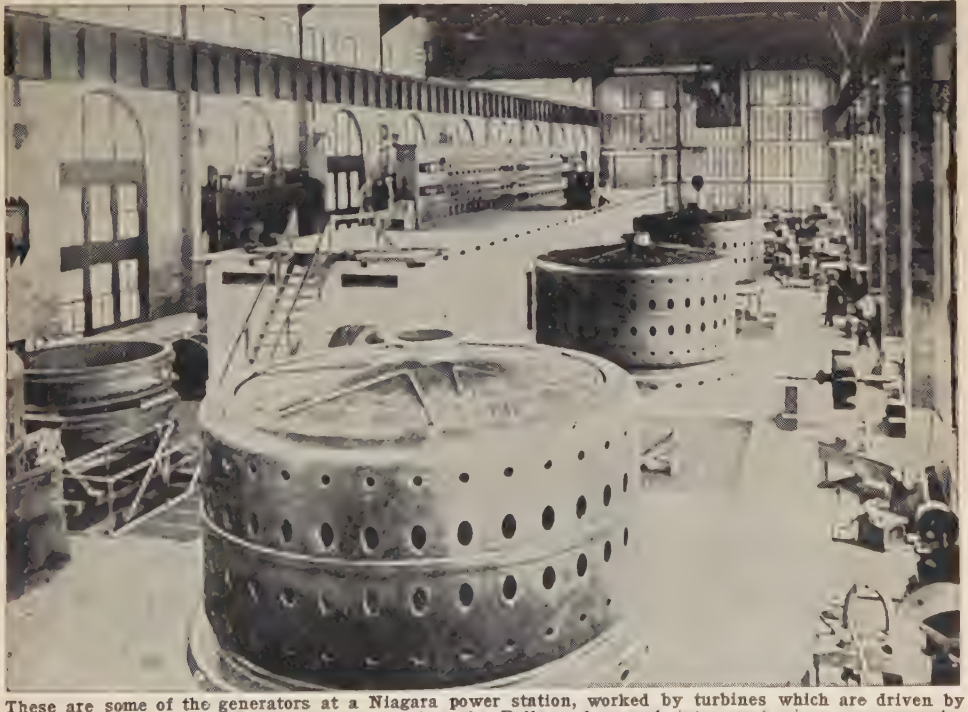
A WONDERFUL PIPE-LINE MADE OF WOOD

In the great timber lands and in the mining regions of British Columbia water power is in great demand, and the water of rivers is conveyed for miles in pipe-lines made of wood-staves bound round with iron.

THE BIGGEST GENERATOR IN THE WORLD

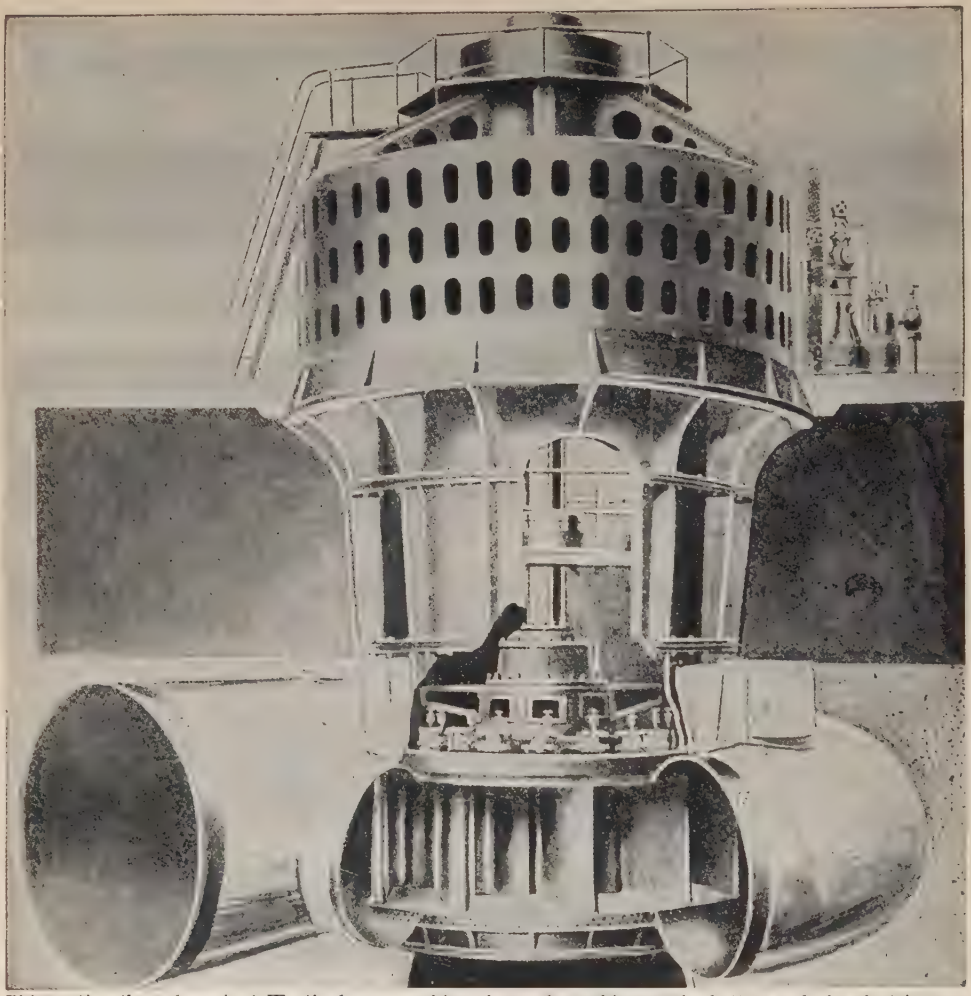


Here we see the largest electric generator in the world being set up at a Niagara power station, where it now produces electricity for a score of cities. It lights more than two and a half million lamps.

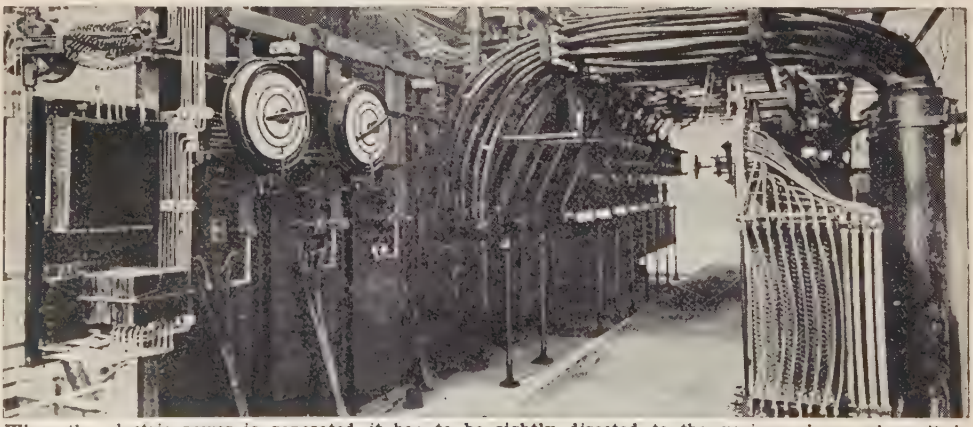


These are some of the generators at a Niagara power station, worked by turbines which are driven by water drawn from the river before it reaches the Falls and passed into great pipes, or penstocks.

HOW WATER IS TRANSFORMED INTO POWER



This section through a giant Westinghouse machine shows the turbine at the bottom and the electric generator at the top. Water is hurled against the blades of the wheel, which revolves and drives the generator.



When the electric power is generated it has to be rightly directed to the various places where it is required for use, and here we see the back of a big switchboard at a modern water-power station.

THE FORBIDDEN ROOM

THERE was once a magician who took the form of a beggar and went from house to house stealing all the prettiest girls, none of whom ever came back again.

One day he begged for scraps of food at the door of a man who had three very pretty daughters, and the eldest one gave him bread. When she was not looking he touched her arm, and against her will she found herself compelled to jump into his basket. Then he took her to his house in the middle of a thick forest, where everything was magnificent, and she had all that she could possibly desire.

After some days he told her that he was going on a journey, and handed to her the keys of the house, saying that she could go into all the rooms except one. If she entered that room, she would die. At the same time he gave her an egg and told her to be very careful not to lose it.

No sooner was he out of sight, than, still holding the egg he had given her in her hand, she went all over the house, and found the rooms filled with lovely things. At last she came to the door of the forbidden room, and, after hesitating for a while, her curiosity got the better of her and she went in. To her astonishment, she found there a number of girls imprisoned by the magician. They lay as if asleep, and frightened by their stillness, she fled from the room and rushed away.

In her terror she dropped the egg. It did not break, but when she picked it up she found that it was smeared with red, and, in spite of all her attempts, she could not clean it.

A few hours later the man returned and asked at once for the keys and the egg. When he saw the red mark on the egg, he knew that she had been into the forbidden room. Throwing her on the ground, he dragged her back into the secret chamber and imprisoned her with the others.

He then set off again to the house where he had begged, and this time he captured the second daughter. She, too, yielded to curiosity, and met with the same fate as her sister.

Finally the wizard captured and brought away the remaining sister; but this one was cunning, and when, in her turn, she received the keys and the egg before the man went out, she at once put the egg carefully into a cupboard. Then she took the key and went into the forbidden room to see what it contained.

Here she was astonished to see the floor covered with girls fast asleep, among them her two sisters. But being wiser than the others, she had taken care of the egg and kept it clean. When the wizard came home, she ran to him with the keys and the egg, and seeing that the egg was clean, he exclaimed: "You shall be my wife, for you have stood the test well."

But the magician was now no longer able to do as he liked, for his bride had broken his power and was able to

do with him whatever she would. So she went into the forbidden room and awakened the sleeping prisoners, who had been held bound by the wizard's spell.

Then she said to him: "Before I marry you, you must carry a basketful of gold to my parents."

Taking a very large basket, she put her two sisters into it and covered them over with gold coins. Next she told the man to carry the basket, and not to stop anywhere, as she would certainly watch him from her little window.

The man put the basket on his shoulder and started, but found it so heavy that he was ready to drop with fatigue. So he sat down to rest; but instantly a voice from the basket said, "I am watching from my little window." Thinking it was his future wife calling after him, he started up and struggled on. Every time he tried to rest, the same thing happened, until he reached the parents' house.

While he was on his journey his intended bride took a painted head, decorated it with flowers, and placed it at an upstairs window, as if it were someone looking out. Then she set free all the wizard's victims, and sent out invitations to the wedding. Next she covered herself with feathers, so that she looked like some queer bird, and no one could recognize her. After this she started from the house and met some of the guests, who said:

In her disguise, the magician's bride met the guests, who said: "Fairy bird, whence do you stray?"

"Fairy bird, whence do you stray?"
"I came from the fairy's home this day."
"And what has become of the young bride, say?"
"She has garnished the house all in and out,
And now at the window she's looking out."

The wizard returned, saw the head at the window, and went into the house. At once the friends of the three sisters locked the doors and set the house on fire. And that was the end of the wizard and his forbidden room.

THE WISEST MAID IN WESSEX

IN the ancient days there was a King of Wessex whose name was Ina. He was a tall, brave, handsome man, but he had a great failing. The least thing irritated him and threw him into a sudden fit of wild anger. Knowing this, he resolved to marry a wise maiden who could restrain him and govern him.

One afternoon he rode out from Winchester into the great forest, and feeling thirsty, he stopped at a woodman's hut to get a drink of milk. The woodman's pretty daughter Edith brought him some milk, and when he gave her back the mug he said: "I am King Ina of Wessex. Empty all the seas of the world with this mug and I will make you my Queen."

Edith went into the hut, and brought out a handful of tow, and gave it to King Ina, saying merrily: "Stop up with this tow all the rivers of the world and I will do as you wish."

"You are the girl I've been looking for," said King Ina.

And he set her upon his horse and led her to his palace at Winchester. But just before they were married Edith said to him: "You know you have a very hasty temper. So promise that if you are ever angry with me and send me out of the palace you will let me take a parting gift, that I shall choose, away with me."

King Ina, of course, agreed to this. For some time, however, there was peace. As they were sitting at supper one night, Ina was offended by some good advice which his wife gave him, and he cried: "You interfere too much in my affairs. To-morrow you go back with your father to the hut."

Queen Edith answered nothing, but when her husband's back was turned, she put a drug into the mead he was drinking, and this made him fall into a deep sleep. Then she had him carried gently to the hut in the forest.

"Who brought me here?" he shouted, on awakening the next morning.

"I did, dearest," said Queen Edith. "You are my parting gift."

"Ah!" said King Ina, kissing her. "I did well in marrying the prettiest maid in Wessex, who is also the wisest!"

THE FAIRY MAID OF VAN LAKE

A SHEPHERD lad from Mothvey was tending his sheep one afternoon beside Van Lake, in the Black Mountains of Wales, when three fairy maids came out of the water and began to play on the grass. All were beautiful with a beauty never seen on mortal face, but the youngest was the loveliest; and the shepherd fell in love with her and won her as his bride. On the wedding-day the fairy came out of Van Lake, and brought, as a dowry, three cows, two oxen and a bull, and the marriage was joyfully celebrated at Mothvey Church.

"Now mind," said the fairy maid to her husband, "if ever you strike me three times without cause, I shall have to return to Van Lake."

The shepherd said he would never dream of touching her, and they lived happily together, and three little boys were born to them. But when he asked his wife to go for a horse for them to ride to the christening, she quite forgot to do so, and without thinking about her threat he slapped her on the shoulder, telling her to do as she had been bidden.

"That's one," said the fairy.

Soon afterward they went to a wedding, and instead of merrymaking, the fairy cried all the time, just as though she were at a funeral and everybody was sad.

"Why do you cry?" said the shepherd, slapping her on the shoulder.

"Because the marriage will prove unhappy," she replied. "And mind! You have now struck me twice."

The shepherd became very careful, for he certainly was very anxious not to lose his wife, but later, at a funeral, his wife shocked everybody by laughing and dancing. Quite forgetting himself, the shepherd tapped her, saying: "Is this a time for rejoicing?"

"Yes," said the fairy. "The baby has escaped the sorrows of earth and entered the Kingdom of Heaven. But that's the third blow. Farewell!"

As she entered Van Lake her cattle followed her. When her three sons grew up, however, the fairy maid appeared again and gave them the gift of healing, so that they all became famous physicians.

THE FACE NO MAN COULD LOOK ON

THE MARVELOUS ADVENTURES OF PERSEUS

AN old fisherman was fishing one evening on the Greek island of Seriphos when he saw a strange sight. A chest came floating in on the waves, and in the chest sat a beautiful lady, nursing a pretty little boy.

"Save me and help me!" cried the lady. "I am Danae, the daughter of the king of Argos, and this child is my son Perseus. My father has driven us forth like this because of an evil prophecy that Perseus should be the one who would some day cause his death."

The kind old fisherman took Danae and Perseus to his house, and there they stayed with him until Perseus was old enough to earn his own living. Then he became a sailor, and grew strong and hardy. At the age of fifteen he was a very remarkable lad. He stood a head taller than any man on the island, and he was the champion in every kind of warlike sport. And he had need to be, for, on returning from one of his voyages, he found his mother was no longer there.

Perseus rescues the beautiful Princess.

"The King of Seriphos has fallen madly in love with her," said the old fisherman. "And as she will not marry him, he has imprisoned her."

Perseus strode into the palace, his eyes blazing with anger, and there he discovered his mother and set her free. For he looked so terrible that no man dared oppose him. And he was about to kill the king when his mother said: "Perseus, we are strangers in this place. If you harm the king, all the people will attack you."

So Perseus spared the king; but the king laid a plot to get rid of the brave boy and force the mother to become his wife. He prepared a great feast and invited all his lords; and he also invited Perseus. Now, it was a custom on these occasions for every guest to bring the king some costly gift; but as Perseus was a poor sailor lad, he came to the feast with nothing to give. And when the time came to present the gifts, all the lords scoffed at him. But Perseus then remembered a strange vision which he had had. Athene, the Goddess of Wisdom, had come to him in a dream, and she had told him to go forth and slay her enemy the Gorgon, and she had promised to help him. So when the lords scoffed, he cried: "Wait, and I will bring the king such a gift as no man has ever seen. I will bring him the head of the Gorgon."

"Go, then," said the king, "and never return until you bring it."

He thought that he had sent Perseus to a certain death. For the Gorgon was a terrible woman, with a face on which no mortal could gaze without turning into stone. But Perseus went down to the cliff by the sea and waited, and Athene again appeared to him, and with her came another spirit, called Mercury. And she gave Perseus her great polished shield, and Mercury gave him his magic sandals and his enchanted sword.

"My enemy the Gorgon," said Athene, "dwells in the cold lands where the north wind blows. Go there and attack her. But beware of looking at her face.

Watch the reflection of it on my polished shield, and turn your eyes away when you strike her. Now put on the sandals, and leap off the cliff."

Perseus did so, and, instead of falling into the sea, he began to travel with great swiftness along the air on the magic sandals. On and on he went, until he came to the desolate place where the Three Gray Sisters dwelt. And the Three Gray Sisters told him to turn southward and go to the Garden of the Hesperides. And Perseus turned southward, and came to the Sunset Land, where the Hesperides lived. And he saw the young and beautiful Hesperides singing and dancing in their garden around an enchanted tree laden with golden fruit.

And one of these lively nymphs took pity on the brave, handsome lad, and said to him: "The Gorgon will turn you into stone if she is able to see you. You must wear the Hat of Darkness, and then you will be invisible."

And she went down into the Underworld and brought Perseus the Hat of Darkness; and Perseus put it on and became invisible. He then traveled on the magic sandals to the cold land from which the north wind blows. There he held up the polished shield, and looking into it he saw the Gorgon sleeping beside her sisters on an island.

Her face was pale and beautiful, but instead of hair she had serpents growing out of her head. The serpents could not see Perseus because he wore the Hat of Darkness, and he came close up to the Gorgon, looking all the time at the reflection in the polished shield; and then, with one stroke of the sword, he cut off her head, and, still without looking at it, he wrapped it in a goatskin. Then, before the two sisters of the Gorgon could seize him, he mounted a winged horse named Pegasus, which sprang from her blood, and soared up and traveled to the land of Iopa.

Seeing a white statue standing under a black rock by the shore, he descended, and found that it was a beautiful girl chained there, and the girl cried: "Do not set me free. I am Adromeda, the daughter of the queen of Iopa, and I am chained here as a sacrifice. For my mother boasted that I was fairer than the Queen of the Sea, and the Queen of the Sea has sent a sea-beast to ravage Iopa. Only by offering me as a sacrifice can the land be saved."

But, when the monster appeared, Perseus unveiled the head of the Gorgon, and the monster saw it and turned into a great long stone. The hero then married Andromeda and sailed with her to the island of Seriphos.

"Ha, you braggart castaway!" cried the king. "So you find it easier to make a promise than to fulfill it?"

Perseus showed the head of the Gorgon, and at the sight of it the king and all his scoffing lords were turned into stone. Perseus then made the kind old fisherman king of Seriphos, and led his mother to the ship and sailed with her and his lovely wife to Argos.

There, after killing his grandfather by accident while playing quoits, as it had been prophesied, he settled down with Andromeda and his mother, and the people made him king of the land.

THE YELLOW DWARF

THE STORY OF PRINCESS BEAUTIFUL AND THE KING OF THE GOLDEN MINES

PRINCESS BEAUTIFUL was the loveliest maiden on earth. All the great rulers in the world desired to marry her, and at last she was wooed and won by the brave young King of the Golden Mines.

But just before the wedding-day the king fell ill. No doctor was able to cure him, so the mother of the princess resolved to get a magic remedy from the fairy of the Emerald Palace who lived by the seashore at the end of a valley that was guarded by two lions. As the lions ate up everybody who did not feed them with a certain kind of cake that they liked, the mother of the princess took some of this cake with her in a basket.

On reaching the valley she felt very tired and fell asleep beneath a tree. But suddenly she was awakened by the roaring of the lions, and picking up her basket, she found, to her horror, that the cake was gone!

"Ha, ha!" said somebody in the tree above her head.

She looked up and saw an ugly yellow dwarf sitting amid the leaves with the cake in his hand.

"Oh, give me my cake," she cried, "or the lions will eat me up!"

"Yes," said the Yellow Dwarf, "if you will give me your daughter in marriage."

She determined to die rather than consent to this. But when the two lions rushed upon her she was terrified, and said: "Give me the cake, and marry my daughter!"

The Yellow Dwarf gave her the cake, and she fed the lions with it, and they let her pass unharmed. She then went through the valley to the Emerald Palace by the seashore and obtained from the fairy the magic remedy, and with this she returned home and quickly cured the brave young King of the Golden Mines.

"Now, if I hasten on the marriage between the two lovers," she said to herself, "the Yellow Dwarf will be foiled!"

So preparations were at once made for the ceremony. Princess Beautiful and the King of the Golden Mines were as merry as singing birds in the month of May, but the mother of the princess was pale with anxiety, though she had seen or heard nothing of the Yellow Dwarf. On the way to the cathedral she kept urging the coachman to drive faster. But all her haste was useless.

"Ha, ha!" said somebody, when the wedding procession arrived at the cathedral.

The mother of the princess looked up, and saw the Yellow Dwarf sitting above the porch. Before she could utter a warning he swooped down through the air, seized Princess Beautiful and disappeared.

The king, too, was lifted up and whirled away. When he recovered, he found himself in the Emerald Palace of the fairy, for, having come to the cathedral to help the Yellow Dwarf, she had fallen in love with the king at first sight, and carried him off.

The fairy did all that she could to win the heart of the king. She gave him the finest suite of rooms in the Emerald Palace, and held all kinds of balls and festivals there in his honor. But he used to wander sadly all day long by the seashore.

One morning a lovely woman swam up to him. As she approached he saw that she was a mermaid and had a fish's tail.

"Ah, King," she said, "you and Princess Beautiful are indeed an unhappy pair of lovers. The Yellow Dwarf has carried her to his castle on the other side of the sea, and, like you, she wanders sadly all day long by the shore."

"Can you take me to her?" cried the king.

"If you will sit on my tail," said the mermaid.

The king did so, and the mermaid swam with him across the sea to the castle of the Yellow Dwarf. Then she gave him a diamond sword, and said: "Never let go of this sword until you have won the princess."

On arriving at the castle the king was attacked by four unicorns. Placing his back against a great oak, he let them rush upon him and drive their long, sharp horns at him. But just as they were about to pierce him he dropped down, and crash! went the four horns into the tree, and there the unicorns remained fixed while he killed them with the diamond sword.

At the gate of the castle he found Princess Beautiful, and threw himself at her feet. But in doing so he let go of the diamond sword, and the Yellow Dwarf, who was watching behind the gate, sprang out and picked it up, and said: "Princess, the time has come for you to make your choice. Marry me, and I will let the king depart unharmed; refuse, and I will slay him!"

"I will marry you!" said the princess.

In his joy the Yellow Dwarf also let go of the diamond sword, and the king snatched it up and cut off his head.

Then the lovers returned to the mother of the princess, and this time the marriage took place.

In the years afterward, when the palace was lively with little princes and princesses, the royal children loved to gather around their grandmother's chair and listen to her stories about the hungry lions and their favorite cake, the mermaid and the unicorns, the jealous fairy of the Emerald Palace, and the ugly old yellow dwarf who had captured their lovely princess mother and tried to keep her from marrying their own brave father.

THE NEXT STORIES ARE ON PAGE 5529.

THE YELLOW DWARF SITS IN THE TREE

"Ha, ha!" said someone in the tree. The mother of the princess looked up and saw a dwarf sitting amid the leaves with the cake in his hand. "Give me my cake," she cried, "or the lions will eat me up."

WHERE BEAUTY RAGES AND SLEEPS

A night scene at Kilauea, Hawaii National Park, taken during a time of great activity in the firepit. The level of lava in this Lake Fire rises and falls at intervals.

There are scenes in Hawaii that can never be forgotten. Here we have a moonlight view of a row of palms bordering a lagoon. In the background, on the slopes of the distant hills, are sugar and pineapple plantations.

Photo, Williams Studio, Honolulu.

Beautiful Waikiki Beach, Honolulu.

HAWAII, AN ISLAND PARADISE

EVERY year many people visit the Hawaiian Islands, so we shall here describe the eight principal islands which form this territory of the United States. Some scientists say that the island of Hawaii is the oldest of the group raised in the Pacific Ocean by a volcanic upheaval when the world was young; others say that it is the youngest. Perhaps some day the geologists will be able to settle the question, but so far they have not agreed. However, this island is the largest of the archipelago, as a group of islands is sometimes called, and formerly it was the most important. It is most closely associated with the history of the natives, and it was the first of the group to become known to the white man. Also it gave its name to the whole territory. Lately Oahu has become the commercial and social centre.

Hawaii is shaped like a rough triangle and has an area of 4,210 square miles. Its surface consists mainly of the slopes of five volcanoes; and as visitors approach it they are awed by its majesty and impressive grandeur as it looms out of the blue Pacific. Unlike the other islands, it has few coral reefs along its coast, and therefore has no good harbor. The great volcanic peaks of Hawaii are Mauna Kea, which means "White Mountain," and Mauna Loa, which means "Great Mountain." Mauna Kea is snow-crowned and extinct, but Mauna Loa is still very active. So, too, is Kilauea, a much smaller peak. Kilauea is the most active volcano in the world, and is celebrated for its Lake of Living Fire. The Kilauea crater is three miles across. From Hilo, the chief city of the island, there is a splendid motor road to the edge of the crater, and for most of the way huge ferns and brilliant flowers make the journey one of great beauty. This road leads through large sugar plantations, through tropical jungle, over vast lava beds, and past steaming earthquake cracks, banks of pure sulphur and tunnels bored by flowing molten lava. It is this section of Hawaii that is known as the Hawaii National Park.

The most fertile regions of the island are North and South Kona, on the western side, where the high mountains break the force of the trade winds. A regular rainfall and wonderfully fertile soil make this section the richest in the territory. The climate is mild and genial. Professor J. K. Goodrich, in one of his books on Hawaii, writes that

the Hawaiians used to say, "People do not die in Kona; they simply shrivel up and blow away!"

Maui, the second largest island of the group, has an area of 728 square miles and lies about twenty-six miles northwest of Hawaii. It consists of two mountains connected by an isthmus. On this island is the mammoth extinct volcano Haleakala, which rises over 10,000 feet above sea-level and has a crater nineteen square miles in area, the largest of its kind on the earth. Under the other peak, Puu Kukui, lies the Iao Valley, often called the "Yosemite of Hawaii."

West and southwest of Maui are two small islands, Kahoolawe and Lanai, 69 and 139 square miles in extent. They are covered with low mountains and are given over almost entirely to sheep-raising.

Molokai, which is a few miles northwest of Maui, is larger than the two just mentioned, and has a Mauna Loa of its own. In the northern part of the island are precipices ranging in height from 1,000 to 4,000 feet. On a low peninsula jutting out to the north is the famous Leper Settlement, about which we read on page 3586.

Oahu, the next in a northwesterly direction, is the most important island of the territory at present. It forms a rude square and incloses about 600 square miles of land. Toward the northeast and southwest are mountain ranges, of which the tallest peak is Mauna Kaala. Between the ranges is a plain about nine or ten miles across and twenty miles long. Oahu has the two good harbors of the archipelago, for great coral reefs lie off the coast, and breaks in these permit entrance to smooth lagoons. Pearl Harbor has been taken over by the United States Navy Department as a naval base. The other harbor gives entrance to Honolulu, the capital, a very modern and delightful city.

THE CITY THAT HAS BEEN DOWERED WITH BEAUTY

It is doubtful if any other city in the world has been so richly dowered as Honolulu. Before it smiles the shining Pacific as azure as the heavens above. Around it mountain and valley vie with each other in producing tropical pictures that are almost too beautiful for this world. Royal palms line the broad avenues of the city itself, and blooms of rare and startling color and size are found in all the gardens. Yet here, too, are found street cars and all the modern conveniences that the white man demands for his comfort. The beaches, of which Waikiki is the best known, are famed for bathing, canoeing and surf-riding. There is no undertow nor are there sharks at Waikiki, for the beach is separated from the ocean by the coral reef. Even in the Hawaiian winter season the water is warm.

Near the city is the Nuuanu Valley, over which hangs the frowning Pali, or precipice, 1,200 feet above the sea. It was down this precipice that King Oahu's warriors flung themselves when defeated by Kamehameha toward the end of the eighteenth century. There are magnificent views to be had from the summit of the Punch Bowl, an extinct volcano, from Pacific Heights or the Tantalus. The motor drives up the Manoa Valley and around Diamond Head are very fine. There is a motor road, ninety miles in length, around the entire coast.

Kauai, 547 square miles in area, lying northwest of Oahu, is a mountainous island circular in shape. It has a number of well-watered valleys which are so fruitful that it has been called the "Garden Isle."

The last of the inhabited islands is Niihau, 97 miles in area. Two-thirds of Niihau is made up of a low plain formed from a coral reef covered with soil washed down from the mountains on the east coast. This island is private property, and 60,000 acres are used for stock-raising. Niihau is noted for the rush mats and the pretty shell chains made by the natives. There are scores of very small islands in the territory, but they are of little importance.

THE CHINESE KNEW THE TERRITORY AS THE "SANDALWOOD ISLANDS"

The Hawaiian Islands are known for the luxuriant tropical growth of trees and plants. The Chinese name for the group means the "Sandalwood Islands," and the sandalwood tree was in great demand in China for medicinal purposes, for joss sticks, for incense and for cabinet-making. Unfortunately the demand almost cleared the islands of such trees. The United States Forest Service is paying much attention to the conservation and replanting of the sandalwood, and hopes to make it a valuable resource once more. On the islands of Hawaii and Maui there are

THE MODERN CITY OF HONOLULU

This is the Executive Building, formerly Iolani (Royal) Palace. In it are housed all departments of Hawaii's territorial government, including the offices of the governor. In this palace reigned royalties famous in the history of the Hawaiian Islands.
Photo, Williams Studio, Honolulu.

Honolulu to-day is a modern American city in every respect. Here we see the downtown business section. Street cars and automobiles are the means of transportation, just as they are in any continental United States city.
Photo, Covell, Honolulu.

large forests of *koa,* which give valuable lumber known as Hawaiian mahogany. Banyan, coconut, royal palms, banana and giant tree ferns are common, and the white man has introduced ironwood, bluegum and rubber trees.

Among the smaller plants or bushes are arrowroot, yams, sugar-cane, raspberry and Chilean strawberry and *taro. Taro,* or *kalo,* forms the principal food of the natives. The root is pounded in water until it is half liquid, and the mixture is allowed to ferment. The result is the famous *poi,* served in a bowl into which each person dips his fingers and skillfully catches up a mouthful. From the inner bark of the mulberry tree a fine and beautiful cloth, *tapa,* is woven. Another plant, *ti,* supplies thatching for the roofs of the houses and also a drink.

ALOHA AND LEIS GREET THE NEW ARRIVAL

The gorgeous flowers of infinite variety are unsurpassed anywhere, and many charming customs are connected with them. Visitors arriving or leaving are garlanded with *leis*—chains of blooms—and the word of greeting is *Aloha,* meaning "welcome" or "my love to you." This word, which has become known throughout the world, is also used to mean "farewell" or "kind regards."

The animals native to the islands are few and unimportant, but there are many kinds of birds. The *mamo* is the most prized, for from it are obtained the golden feathers of which were made the war cloaks of the chiefs and kings. The purple plumage of the *kahili* is made into fans. Brilliant scarlet feathers from the *O-o* are also used for ceremonial robes. There is a curious bird, the firebird, which has a fiery red topknot, and the natives believe that it stole fire from heaven and introduced it in the islands.

Before the downfall of the Hawaiian kings these gorgeous birds were protected by the royal order forbidding the killing of the winged beauties that provided the material for the regal raiment. They were also protected by the ancient priests, who taught the natives that in the cries of the birds were borne messages from the gods. When the monarchy was abolished and the people were converted to Christianity, the brilliant feathers lost their meaning and soon came to be worn by all classes of the inhabitants. The unfortunate birds became the objects of desire of many hunters, who sold the plumage to traders or tourists. Some bird species are almost extinct now.

In the blue waters which girdle the islands and in the lagoons which pierce them are found many varieties of fish. Some of these seem like bits of rainbow, so varied in color are they. Game fish, such as swordfish, tuna, oceanic bonito and albacore, abound. Swine, cattle, sheep and horses, as well as domestic fowls, were brought in from abroad.

SUGAR AND PINEAPPLES ARE THE PRINCIPAL EXPORTS

Almost every agricultural crop can be grown in the Hawaiian Islands, but at present sugar is the main product. Sugar-cane is native, and Captain Cook saw the natives using it for food when he discovered the islands. In 1924, 678,000 tons of sugar were raised. Next in importance is the growing and canning of pineapples, and many millions of dollars' worth of canned pineapples are exported each year. Rice is another large crop. It has been found that rubber trees flourish in the territory, and the United States Government has encouraged the industry, which has increased until the output has become important. Coffee-growing was introduced by Europeans, and now there are large plantations. The cultivation of tobacco has also flourished. Banana-growing has been a feature of island agriculture, and is one of the principal exports. Cotton has done splendidly in certain localities.

The population of the islands now includes many nationalities. For the children of all races there are excellent public and private schools. There is also a university. The Bishop Museum at Honolulu is a scientific institution devoted especially to the preservation of specimens and facts connected with the life of the territory and Polynesia.

The Hawaiian Islands have been called the "Paradise of the Pacific," and every year the stream of visitors from continental United States increases. There are no snakes or poisonous plants, and there is no malaria. Fogs and hurricanes are unknown; storms are few. Snow is found only on the highest peaks. The climate at sea-level is that of perpetual spring. If we add to these blessed qualities the natural beauty of the islands we can see that the territory well deserves its nickname.

THE TWO GREAT HAWAIIAN CROPS

The territory of Hawaii produces the world's finest pineapples, the 1925 pack being more than 7,000,000 cases. One cannery in Honolulu preserves 1,000,000 cans a day. Pineapples take about a year and a half to ripen. Most of the crop is packed in summer.

Photo, A. F. Hill, Honolulu.

Copyright, 1923, by A. C. Bixby, San Francisco.

Sugar is the Hawaiian Islands' chief agricultural crop. Here we see a plantation of the Waimanalo Sugar Co., located a few miles inland from Honolulu.

Photos on these pages courtesy Matson Navigation Company, California.

The Bullfrog.

The common English Frog.

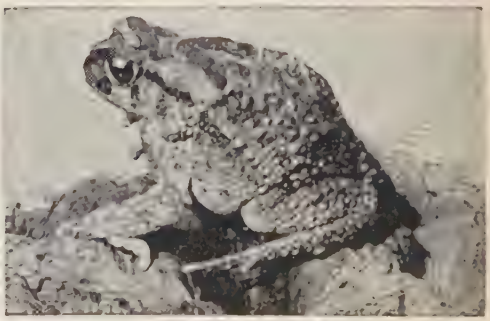
The Giant Tree-toad.

The South American Giant Toad with a European Toad on its back.

The Bladder Frog.

The South African Bullfrog.

The Australian Tree-frog.

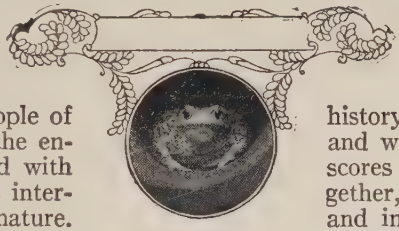


The Moorish Toad.

The Painted Frog.

The Burmese Frog.

THE WONDERFUL AMPHIBIANS



THE clammy and often slimy skin of the Amphibia causes them to be detested by people of sensitive touch, and the entire Order is regarded with disdain except by the interested student of nature. Possibly a toad or a frog, if it could think and knew its tremendous history, would return the contemptuous feeling, for what upstarts we are in comparison with a newt or a salamander, or even the toad!

They are the true aristocrats of the earth, so far as age confers distinction. They were the Columbuses who discovered the dry land of the earth. The world and its fullness were theirs before even the reptiles rose and conquered.

And these creatures relive their wondrous history before our eyes, presenting to us a life-story as astonishing as anything imagined in fiction. Who, if he did not know the strange secret, could answer this conundrum: What is it which first lives in water and drowns in air, next lives in air and drowns in water, then buries itself at the bottom of water and breathes nothing? That is, in a sentence, the life-story of the common American frogs.

When we come to consider it, this emergence of the Frog from the water stands as a chapter of natural history unexcelled in interest and wonder. First the egg, scores or hundreds laid together, in a mass by the frog, and in strings by the toad. The egg is contained in a protecting capsule which takes up water when the egg is laid and swells almost to the size of a pea. In it is a considerable mass of yolk and the minute life-germ from which all the mystery is to appear. The upper part is dark-colored—a perfect example of design in Nature, for this coloring helps to keep in heat from the atmosphere and so warm the germ into life.

Hatched—after perhaps five days—the future landsman is little more than a fish, and a queer fish, too, with external gills, no fins and no mouth, living on the capital with which he entered the world—the unexhausted supplies of yolk from the egg. In two or three days this is absorbed and the mouth is formed. It is rather of the lamprey type, with horny jaws and lips intended only for rasping. Thus armed, the tadpoles scratch off nutriment from vegetation, from flesh, from anything that can be taken from the water, into the hungry stomach of this little feeder in the deeps.

THE MARVELOUS CHANGE THAT TAKES PLACE IN A FEW WEEKS

Amazing changes soon follow. The outer gills fade away and new ones develop internally. The water taken in through the mouth is squeezed out through a spiracle, surrendering its oxygen in the process.

Two limbs bud out toward the rear, but they are not yet needed for progress, as the rudder-like tail serves to propel our little friend about his business. Seven, eight, nine weeks pass, great alterations taking place slowly all the time. The tadpole becomes less and less able to exist on the oxygen of his native medium, and, like a fish in overcrowded waters, he comes more and more to the surface to take gulps of air. Lungs form before the gills have quite ceased to function, and the tadpole can breathe either water or air. The front legs appear and are thrust out of the openings which the gills first occupied.

Then comes the greatest transformation of all. The land begins to call, with promise of unknown realms to explore. In this serious crisis the tadpole ceases to feed so that his jaws may undergo a new change.

But there is a storehouse of nutriment in his big fat tail, and as we watch we see day by day that this organ diminishes. The tadpole is living on it.

THE DANGER THAT LIES IN THE TAIL OF A FROG

At last the whole transformation is accomplished, the horny jaws drop off, and in a twinkling the tadpole has gone and a tailed frog appears, as big as a button. The remnants of the tail are there and must be absorbed—then the little frog is perfect.

There is now great peril in the tail. In climbing from the water to the land little froggie has to pass over parched stretches of bank, and repeatedly one has found that the moist tail, sticking to the surface, has sealed down its little owner and fixed it there to die, dried up in the pitiless sunshine. Therefore, whereas a great tail may give a tadpole a richer store of food in the water than a small-tailed tadpole has, a baby frog which comes out of the water with too much tail left may never gain freedom ashore.

All these astonishing events are covered by the three months of spring. Then summer summons all life into teeming activity; and from that hour the frog, so conspicuous and frisky as a careless creature of the pond, seems to follow the advice of a saint and "love to be unknown." It hides by day in damp places, and splashes for safety into rushy waters when pressed.

But it can no longer live in the water. Its food—insects, worms and slugs—are on land, and the frog must now have abundant air to breathe.

But when autumn gives place to winter our cold-blooded little friend must betake himself again to his cradle. He plunges into the water, dives down into the mud at the bottom, falls asleep and rests there, the living image of a drowned frog. But he bobs up serenely in the spring, and the water seems to boil with his activity and ardor.

THE DIFFERENCE BETWEEN A JUMPING FROG AND A CRAWLING TOAD

That is the life-story, in brief, of any of our common American frogs. The Bullfrog, a tremendously long-lived animal, takes longer to reach maturity; it requires three years to pass from the larval stage to the perfect. But if other frog tadpoles are starved in foodless waters, they may have to wait for a second summer before they can make the great transition.

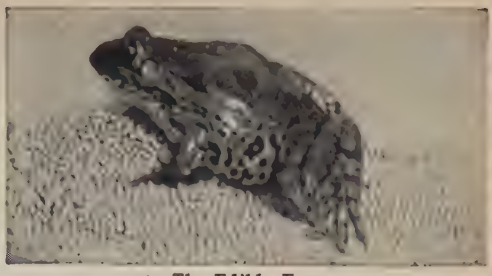
Frogs and toads are grouped together, of course, for there is much in common between them, yet there are notable differences. The Toad is shorter of limb than the frog, and, instead of leaping, he sometimes crawls. And whereas the frog must keep in a moist environment or dry up like a cut flower, the toad is formed so that he can carry sufficient moisture within his skin to enable him to live for great periods while he is apparently fasting.

This thought leads to the legends running through literature concerning toads having survived alive sealed up in rocks and coal for ages. There is not a word of truth in these reports. Naturalists have frequently shown how false they are, though the explanation is simple. Toads may have been in rocks a few months, possibly years, but if so they have crawled there when tiny, have lived on insects which have crept into their retreats, and have grown too fat to escape from their prison.

In tracing the development of the frog and the toad we might suppose that the

FROGS AND THEIR TOAD COUSINS

The Tigrine Frog.

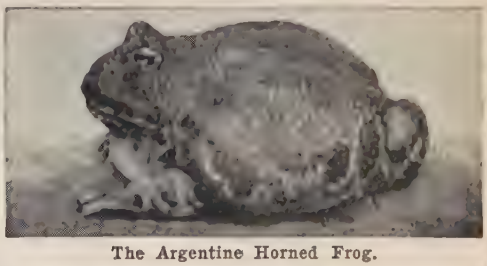


The Edible Frog.

The Common Toad.

The Surinam Water Toad.

The Long-fingered Frog.



The Argentine Horned Frog.

The Natterjack Toad.

The Noisy Frog.

The Golden Tree-frog.

Fea's Frog.

whole story had been told; but it has not. There are multitudes of species, and multitudes of methods employed to get over their cradle days.

The British are but midget frogs and toads compared to some. South America has a toad over eight inches long and weighing over one and a half pounds; but Africa has one an inch and a half larger than that—a toad which eats several mice and similar creatures at a single meal. The American bullfrog is also a monster.

THE TADPOLE WHICH NEVER COMES INTO THE WORLD

At the other end of the scale is a dwarf Argentine Toad only an inch long which pipes and twitters in the love season like an American goldfinch. Moisture is needed for the eggs or young of this Order, and the nest may be in a tree-trunk, in leaves drawn together by the cunning of the parents, or in the hollows of rocks such as those sought by a frog of the Solomon Islands, the thought of which brings us to a distinction of an unexpected character. There is no tadpole stage for this frog. The tadpole never comes into the world. It passes through all its changes in the egg and comes forth a tiny frog quite ready to face the world.

HOW FATHER FROG LOOKS AFTER THE EGGS UNTIL THE TADPOLES COME

Now that is not unique, for a greater wonder still remains to be told. One of the male frogs takes the eggs as they are laid by the female, wraps them about his hind legs and carries them about with him till they hatch. He hides by day in some moist hollow in the bank of a pond, and only when his little ones are ready to emerge as tadpoles does he go into the water.

Stranger still is the nursery habit of the Surinam Toad. The eggs are squeezed out by the male and spread in a layer over the back of the female. At this season the skin on the back of the female is abnormally thick and soft, and the eggs are retained by it like magic, and then quickly overgrown. Each egg has its own little cell on the back of the living incubator. The eggs may number from 60 to 120, and there they lie for three months. In that time all the necessary stages are passed through, and the mother bears about a whole population of little toads with her.

THE DAINTY LITTLE CRADLE UP AMONG THE TREE-TOPS

Then there is the dainty cradle of certain tree-frogs. Here the parents hold together the edges of leaves, or double one large leaf into a cup, and in such receptacle the mother lays her eggs, the glutinous nature of which serves to hold the side of the leaf-cradle in position. But a tadpole comes forth from this cradle in the tree, slips down into the water, and undergoes its transformation there.

Froth, like that of the frog-hopper or cuckoo spit, safely houses the eggs of a West African and a Brazilian tree-frog, whose tadpoles have to complete their change in their castles of foam, for they die if immersed in water!

One other strange case should be noted, the most startling of all. This is a Chilean frog named after Darwin. Dangers must long have threatened the career of this species, for the anxious male will not trust the precious eggs to chance, but takes them into his mouth and there hatches them after long weeks of waiting. This amazing process is brought about by a striking development of a pouch on the male's throat. Apparently the vocal sacs are specially developed at this season of the year in the male, and in that pouch his young pass from egg to complete frog.

In the case of the frogs which have taken to trees there has been some development to fit the frog for its life, notably little sucker disks on the toes to give it a grip of the smooth surface of the leaves. But they also possess in greater measure than any other species the power to alter their color rapidly. In changing their hue to match the general tint around them they almost rival the chameleon. Another admirable adaptation is their power to sit in the scorching sun without harm.

Granting the ferocity of the big frogs, we ought to think highly of the Order. They all eat insects harmful to us, and every garden should have its toads and frogs.

THE SALAMANDER THAT IS OFTEN MISTAKEN FOR A LIZARD

We must make our bow now to the salamanders and newts and their allies. Generally they follow the system of the typical frogs in their breeding habits, but there are important departures, and there is, of course, the notable distinction

that most species not only retain four limbs, but their full tails. Significant exceptions occur, however.

At first sight a Salamander might pass for a lizard, which it closely resembles in appearance and movement, though it is less agile. They may, however, be distinguished by their smooth, damp skin. Most species must have water about their nurseries. It may be that, as with the spotted salamander, the mother does not always deposit her eggs in the water, but may retain them in her body until they hatch. Even so, the young are tadpoles; and must go through their early career as water-breathers. Such a salamander may produce as many as thirty eggs or young at a time. Note, then, the difference between this and the Alpine Salamander.

Our common Red-backed Salamander lays its eggs on land, and the young pass their entire larval life within the egg capsules as in the case of certain frogs. The Alpine species is another which has learned to dispense with a pool for its cradle; the cradle is within the mother's own body. The adults frequent streams and moist woods high up the mountains, but the eggs are not laid in such places. Of the fifty which are retained in the mother's body only two come to life.

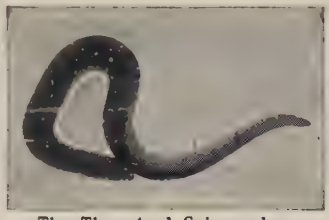
It is a perfect small Alpine salamander that eventually comes forth. The entire tadpole stage is passed through before the little one quits the shelter of its mother's body; and it comes out ready to breathe air at once, and to go about its business snapping up beetles and what not.

The familiar Newts come next to these Alpine salamanders. They are all much more fond of water, however, and their ability to make the best of two worlds has resulted in their spreading over a much wider surface of the earth than is the case with the more specialized ones. Everybody knows the newt, for there is hardly a pond or ditch without these agile creatures. Their tadpole stage is in the water, but afterward they come ashore, hide among green moisture, and return to their pond only for the winter or to lay their eggs.

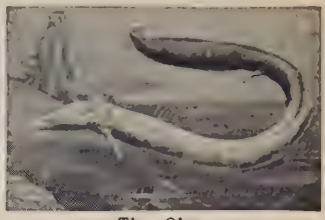
The male British newt carries on his back a handsome fin-like crest, specially prominent in the breeding season.

In most respects newts are alike in habit. Their eggs are attached singly to water plants, the leaves being folded

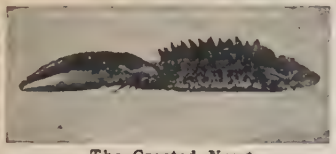
The African Mud-fish.



The Three-toed Salamander.



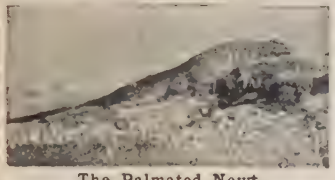
The Olm.



The Crested Newt.

The Siren, or Mud Eel.

A Spanish Newt.



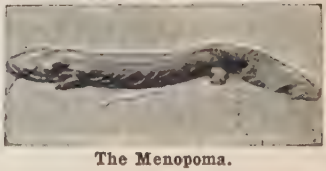
The Palmated Newt.

The Axolotl.

The Smooth Newt.

The Spotted Salamander.

The Common Newt.



The Menopoma.

together by the hind legs of the mother and held in position by the stickiness of the egg. All are carnivorous, and eat tiny worms, small slugs and other enemies of our crops.

Other species of salamanders claim attention, such as the Spectacled Newt, so called from the curious appearance of its head and eyes. It is found in Italy and Sardinia. But we must turn to the Axolotl, which has become the most famous of amphibia.

It is a native of Mexico and many parts of North America. In Mexico, in waters abundant with food, the axolotl swims at ease, a tadpole with true gills, and declines to take the plunge into maturity. It is born a tadpole, it lives a tadpole, and it becomes the parent of other axolotls.

It is not so elsewhere, for outside this Mexican area the axolotl changes into a well-known salamander, the Amblystoma. The axolotl does not remain a child merely because it is too lazy to leave its childhood waters. Something has gone wrong with the mechanism which produces metamorphosis. If this deficiency is replaced by thyroid feeding it will promptly metamorphose. The thyroid is the gland of internal secretion which produces metamorphosis. If thyroid substances are placed in the tank with frog tadpoles, they do the same, rushing the little tadpole in haste through its cycle and turning it into a frog—not of normal size, but no bigger than a fly!

THE GIANT SALAMANDER GROWING TILL IT IS NEARLY FOUR FEET LONG

There are many other interesting salamanders, some of which, dwelling in caves and deep wells, retain their gills and tadpole condition throughout life. There is a true giant of salamanders, native of China and Japan, nearly four feet long and heavy in build. Another is remarkable for having but three toes to each foot; and another, in the Mississippi country, retains gills with its lungs, and apparently lives on fish as well as worms and other fresh-water life.

A still more curious salamander is the Olm, known to science as *Proteus anguinus*. It is a creature of mystery, ten inches long, with the two pairs of limbs far apart, with the eyes completely covered with skin and sightless, though still sensitive to light. Throughout life it retains its gills and remains a water-breather, deep down in the subterranean streams which course through the hearts of the Alps in Carniola, Dalmatia and Carinthia. Only in time of flood is it washed into the light and its presence in life made known. Once upon a time, before it took to this dismal abode of unsunned waters, the proteus must have been a normal salamander, but all efforts to make it follow the old line of development have so far been in vain.

THE SNAKE-LIKE AMPHIBIANS AND THE TALE THEY TELL OF OTHER DAYS

Yet another salamander has so far strayed from the original pattern as to have only two legs. It has gills, but also an internal breathing mechanism for the use of air. One, kept at the Zoo in London, used to climb out of the water and rest in the open during the summer.

There is something snake-like about these salamanders, but we go a step farther with the Cecilians, to find amphibians which have entirely lost their limbs as well as their eyes. They are worm-like in their habit of burrowing in moist soft soil. There the mother lays her eggs and coils herself round them till they hatch. The tadpoles remain in the substance of the mass of egg till they have shed their gills, when they sally forth to the water and complete their larval growth.

A great variety of these curious creatures is spread over parts of Africa, tropical Asia and South America—there are fourteen genera in all—and this wide distribution of a helpless, untraveling group has been used as evidence of the former connection of Africa and South America. That fact alone tells a tale of ancient days.

With the amphibia we say farewell to all the backboned life ashore. Even this last and lowest Order we find replete with variety in form, habit, surroundings—a series of masterpieces. A philosopher once burst into tears in the belief that, the notes of the musical scale being so few, all possible combinations had been exhausted, and no other compositions like Mozart's would gladden human hearts.

Nature has at her command, for the creation of life, fewer elements than the notes of the octave, and she employs precisely the same elements for the making of man and maple and mastodon. But what incomparable variety she conjures from those few!

THE NEXT STORY OF ANIMAL LIFE IS ON PAGE 5539.

A portion of an ancient Egyptian Book of the Dead.

THE LITERATURES OF THE EAST

THE literatures of the East are far older than those of Europe. They are almost equally extensive, and certainly have been the most influential in the history of the world.

On them are based all the great existing religions of mankind. The idea of Immortality has its origin in the literature of ancient Egypt. Taoism, Buddhism, Brahmanism, the religion of the Parsees, Judaism, Christianity and Mohammedanism each has a literature as its source, with some part of the East as its birthplace. Europe cannot make any such claim. Religions that may have grown with, or out of, its early literature have all passed away.

Where the literatures of Europe excel is in the variety of their subjects and treatments, and the world-wide range of their appeal. They penetrate everywhere because they embrace everything. The educated Hindu, Japanese, Chinese or Negro reads the European literatures in proportion to his education; but with the single exception of the Hebrew literature, and in a small degree the Mohammedan Koran, which is an offshoot of Hebrew literature, the world does not read the literatures of the East.

They are studied by specialists for the light they throw on the growth, changes and spread of languages and ideas; for the information they give of the history of religions; and for the glimpses they contain of distant history, early social life, and moral ideas. They abound in poetry and in tales, for poetry and tales are natural to all mankind long before they have a written literature. And because the poetry and tales suit the race which produces them, they descend through succeeding generations to modern times. The poetry of religion, such as hymns and rules for moral guidance, have been specially passed down by priests, and make up a large part of the ancient literatures.

All these forms of literature are plentiful in the East. They attract all students who are engaged on a history of the mental and spiritual development of mankind. Yet Eastern literatures do not contain many of the great literary masterpieces which make a powerful appeal to the world. The outstanding exception is the wonderful literature of the Hebrew race which has been collected from a thousand years and is now translated into nearly all languages under the general name of the Bible. In fact, the only Eastern writing that attracts widespread inter-

est and is not Hebrew, and can be traced to a personal source, is the Koran.

The other important writings that come to us from the East—important, that is, for the light they throw on early language and religion—are of unknown authorship and of great antiquity. They had been long preserved in men's memories before being recorded, and have been handled by priests for centuries. They are mostly connected with the rites of religions that have entirely lost their hold on men's attention, outside of the communities that have inherited them as historical heirlooms.

THE LITERATURE OF ANCIENT CHINA

The language of China belongs to the monosyllabic, or one-syllable, family. The number of its radical, or root, words is made three times as great, however, by a change of accent. As is natural in so great a country, many dialects are spoken in the different provinces, but Chinese proper, the language of the court and of polite society, is spoken in the central province. The Chinese language is written from right to left, in vertical columns or in horizontal lines.

Of the first classics in Chinese literature there are five books: The Book of Transformation, containing sixty-four essays on important subjects based on figures and diagrams; The Book of History which was compiled by Confucius (551–470 B.C.), consisting of conversations between kings and their ministers on politics, history, religion, music and astronomy; The Book of Rites, which is still the rule by which the Chinese regulates his daily life; The Book of Odes, consisting of national airs, chants and odes; the Spring and Autumn Annals of bold historical facts.

We give you one little four-verse poem, which is typical of the odes:

THE ABSENT HUSBAND

I picked and picked the mouse ears,
  Nor gained one basket load;
My heart was with my husband:
  I flung them on the road.

I climbed yon rugged mountain,
  My ponies all broke down;
I filled my golden goblet
  Long anxious thought to drown.

I climbed yon lofty ridges,
  With my ponies black and bay;
I filled for me my horn cup
  Long torture to allay.

I climbed yon craggy uplands,
  My steeds grew weak and ill;
My footmen were exhausted:—
  And here I sorrow still!

There are, besides, Four Books, three of which—the Great Learning, the Just Medium, and the Confucian Analects—were written by the disciples of Confucius; the fourth one consists of the writings of Mencius, a religious teacher and philosopher whose books breathe a spirit of freedom and independence.

The Five Classics and Four Books have had a tremendous influence over millions of minds and therein, rather than in their literary excellence, lies their value.

At the close of the sixth century B.C. it was ordered that various texts should be engraved in wood, printed and published. Printing reached its full development in the eleventh century, when movable types were invented—nearly five hundred years before their invention in Europe.

Books on natural philosophy are plentiful, and some valuable works on Chinese law, agriculture, mechanics and trades. There are many encyclopedias and several dictionaries, composed with great spirit and patience. A celebrated collection of twenty-one histories forms an unbroken record from the third century B.C. to the middle of the seventeenth century; it can be seen in sixty-six volumes in the British Museum. A collection of statistics with maps and tables in two hundred and sixty volumes is called The General Geography of the Chinese Empire, the Statutes of the Reigning Dynasty.

THE LITERATURE OF JAPAN

Japan adopted her written characters from China, and thus absorbed much of Chinese civilization and thought. This state of affairs lasted until the seventeenth century, when a revival of ancient Japanese traditions came about.

Japanese poetry has not suffered from foreign influence so badly. At some remote time a Japanese maker of songs discovered that a peculiar and very fascinating rhythm is produced by lines containing five syllables and seven syllables alternately. There are generally five lines to a poem, though this number is not fixed and sometimes runs to thirty or forty; but the alternation of the five and seven syllables must occur. The smallest example of it is in the *hokku*, a small com-

plete picture containing three lines, or seventeen syllables in all. The two great masters of Japanese poetry were Hitomaro and Akahito, both of the early eighth century. Next to them stands Tsurayuki in the tenth century.

The influence of women in Japanese literature is strong. To women from the eighth century onward was intrusted the guardianship of the pure Japanese language, the Chinese form being adopted only by men. To this day the spoken and written language of women in Japan is simpler, softer and purer than that of the men, who use freely mispronounced Chinese words and employ Chinese characters in writing.

From the fourteenth to the seventeenth century is the so-called Dark Age of Japanese literature, a time when constant warfare darkened the land. It was not wholly unproductive, as it gave the drama to Japan, which in its early beginnings was a religious dance of a pantomimic nature for which the monks of Buddha composed librettos. Costumes of the utmost magnificence were worn, and mask-making became a fine art. From the sombreness of these religious dances, or No, as they were called, the laughter-loving Japanese turned to farce, the Kyogen, or "mad-words," played in the interludes of the No. From these beginnings Japanese drama has developed into the regular theatre, with all the attendant properties and institutions. Though Western civilization has modified it, it has not changed its coloring. With their ability to absorb and imitate, the Japanese have been greatly influenced by Western literature when the Westerners came to their island empire.

THE ANCIENT SANSKRIT LITERATURE

Sanskrit is the literary language of the Hindus, and the name means "cultivated" or "perfected." The Aryan, or Indo-European, race had its ancient home in Central Asia from whence some colonies migrated into Europe, and others through the passes of the Himalayas into India. Thus the languages of Europe and India are merely different forms of the original Aryan speech. *Father, mother, brother, sister* are almost the same whether spoken on the banks of the Tiber, the Ganges or the Thames. In India new dialects were grafted upon Sanskrit and at length replaced it altogether, though it continued to be revered as the literary language of the country.

A greater part of Sanskrit literature still remains in manuscript; it is nearly all composed in metre; it includes every form of knowledge except history—an important lack. The great works of Sanskrit literature correspond to the great ages of history in India. The first period covers the time when Aryan tribes speaking Sanskrit emigrated into northwestern India, where they lived as agricultural and pastoral people. To this era belong the Vedas, or sacred books. Three of these are most important: the Rig-Veda, containing an account of the settlement of the Aryans in the Punjab and their religion and hymns; the Yajur-Veda; and the Sana-Veda. India to-day acknowledges no higher authority in religion, custom and law than the Vedas. There is, besides, a whole library of commentaries on the Vedas which are considered as sacred books also.

In the second period the people, desiring conquests, penetrated into the fertile country between the Indus and the Ganges. Their struggles with the original inhabitants is expressed in epic poems, of which the Ramayana and the Mahabharata are the most striking and beautiful. The scope of both is greater even than that of the Iliad and Odyssey.

To the third period belong the formation and development of an artistic and learned literature. Here we have collections of ancient traditions, expositions of the Vedas and works on grammar and science.

The final period is the golden age of Sanskrit literature, when, under the rule of liberal princes, poetry and drama reached their highest points. The drama is the most interesting branch of Hindu literature. No nation except the Greek has excelled its achievement. Simple plots, purity of language, prose and verse, comedy and music unite in Hindu plays. The Messenger Cloud and Sakuntala of Kalidasa, the Hindu Shakespeare, are unsurpassed.

Modern literature in India consists chiefly of imitations and translations from the Sanskrit, Persian, Arabic and European languages. A modern poet, Sir Rabindranath Tagore, writing in the Bengali tongue, won the Nobel literature prize in 1913, and in English translations he has a large circle of European readers.

BABYLONIAN AND ASSYRIAN LITERATURE

The district between the Tigris and Euphrates geographically forms one country only, though the rival kingdoms of Assyria and Babylonia became, each in turn, superior to the other. Their inscriptions, written in wedge-shaped characters, make up their literature. The key to this cuneiform inscription was discovered by an English soldier, Sir Henry Rawlinson, from some inscriptions in three languages on the face of a cliff. The Babylonians understood the movements of the heavenly bodies, and their chief work on astronomy, compiled for their great ruler Sargon is inscribed on seventy tablets, a copy of which may be seen in the British Museum. Their universities at Erech and Borsippa preserved their learning on baked-clay tablets, which were numbered and arranged; their records on papyrus have not survived.

It was in the reign of Sardanapalus (660–647 B.C.) that Assyrian learning and art were at their height. Three great chambers in his palace piled high with records have been discovered, and their contents restored and deciphered. Among them are the hymns to the gods, which are very much like the Hebrew psalms. There are, besides, two fragments of an epic written around a sun-god, The Deluge, and the Descent of Ishtar into Hades.

Ishtar was the goddess of Love, answering to the Venus of the Latins and the Aphrodite of the Greeks. The object of her descent into the infernal regions was probably narrated in another tablet, which has not been preserved, for no motive is assigned for it here. Possibly she was in search of her beloved Thammuz (Adonis), who was detained in Hades by Persephone or Proserpine.

When Ishtar arrived at the gate of Hades to the keeper of the gate a word she spoke:
"O keeper of the entrance! open thy gate!
Open thy gate! again, that I may enter!
If thou openest not thy gate, and I enter not,
I will assault the door: I will break down the gate:
I will attack the entrance: I will split open the portals:
I will raise the dead, to be the devourers of the living!
Upon the living, the dead shall prey!"

The Porter opens the gate.

The first gate admitted her, and stopped her: there was taken off the great crown from her head.
"Keeper! do not take off from me, the great crown from my head!"
"Excuse it, Lady! for the Queen of the land commands its removal!"

The second gate admitted her, and stopped her: there were taken off the earrings of her ears.
"Keeper! do not take off from me, the earrings of my ears!"
"Excuse it, Lady! for the Queen of the land commands their removal!"

The third gate admitted her, and stopped her: there were taken off the precious stones from her head.
"Keeper! do not take off from me, the precious stones from my head!"
"Excuse it, Lady! for the Queen of the land commands their removal!"

The fourth gate admitted her, and stopped her: there were taken off the small lovely gems from her forehead.
"Keeper! do not take off from me, the small lovely gems from my forehead!"
"Excuse it, Lady! for the Queen of the land commands their removal!"

The fifth gate admitted her, and stopped her: there was taken off the central girdle of her waist.
"Keeper! do not take off from me, the central girdle from my waist!"
"Excuse it, Lady! for the Queen of the land commands its removal!"

The sixth gate admitted her, and stopped her: there were taken off the golden rings of her hands and feet.
"Keeper! do not take off from me, the golden rings of my hands and feet!"
"Excuse it, Lady! for the Queen of the land commands their removal!"

The seventh gate admitted her, and stopped her: there was taken off the last garment from her body.
"Keeper do not take off from me, the last garment from my body!"
"Excuse it, Lady! for the Queen of the land commands its removal!"

After that mother Ishtar had descended into Hades.

We have not space here to dwell more fully on the inscriptions and clay tablets that relate the history and customs of these plain-dwellers of old. You may read about them at greater length in the chapters on Babylonia and Assyria, The Artists of the Old Empires, and Early Sculptors. There is still much to be done in the way of excavation and restoration in the "Land of Two Rivers."

THE LITERATURE OF PERSIA AND THE POETS

Persia has a literature extending from a remote antiquity to the present through many great changes of her language. The earliest Persian tongue, Zend, as seen in the oldest part of the sacred books of the

Zoroastrian religion, the Avesta, still the faith of the Parsees of Bombay, was closely akin to the earliest Sanskrit. That religion symbolizes in the sun a supreme deity from whom comes all good, and it finds expression in outbursts of poetic adoration. Then Mohammedanism swept the country, left the followers of Zoroaster only a remnant, and changed the language and the national thought.

The Persian writers who had vitality enough to appeal to the world outside the Persian plateau lived after the Arab-Mohammedan conquest. Conspicuous among them is the epic poet Firdausi, whose Book of Kings, a mine of romantic story, was published in 1011 A.D. The language of Firdausi may be considered as the purest specimen of the ancient Parsee. There are many episodes of great beauty in this long work. Saadi, a writer of famous Odes, who has been called the nightingale of Shiraz, died in 1292. His two greatest works are the Bustan (Tree Garden) and the Gulistan (Rose Garden).

Greatest of all is Hafiz, the supreme lyrical writer of the Persian race, whose sweetness and melody have attracted notice from not a few poets of the West. Hafiz died in 1389. Jami, who died in 1492, has most beautifully rendered the story of Yusuf and Zulaikha. The poet best known to readers of English is Omar Khayyám, or the Tentmaker, whose pessimistic Rubaiyat was paraphrased in Victorian days by Edward Fitzgerald with such musical melancholy that in its English dress it outcharmed the Persian original and became an English classic. He was the Eastern poet of revolt, preaching the text: "Let us eat and drink, for tomorrow we die."

It is not now supposed that Omar was ever really a tentmaker. Probably he inherited the classification from his father's trade; but he lived a life of thoughtful leisure, pensioned by his sultan as the greatest astronomer and mathematician of his country and time. He lived with his own thoughts and studies and pleasures, and did not aspire to the official dignities and courtly occupations he might have had. His writings on mathematics, in Arabic, and his astronomical observations, gave him such fame that in 1079, when it was deemed advisable to reform the calendar and institute what is known as the Seljuk Era, the formidable task was assigned to him.

THE LITERATURE OF EGYPT FOUND ON MONUMENTS

The literature of ancient Egypt consists only of inscriptions painted or engraved on monuments, or of manuscripts written on papyrus (parchment made from reeds) buried in the tombs or beneath the ruins of temples. Though the language and the written characters of the Egyptians changed through the centuries, yet their literature remained the same in its principal features. In the great period of Rameses, novels or works of amusement were the chief forms of literature; under the Ptolemies, historical records; and in the Coptic period, homilies or church rituals.

The Egyptian priests from earliest times kept the annals of their country, but these were all destroyed by the conquering Cambyses (500 B.C.). They were rewritten, however, and important fragments have been unearthed. The historical papyri that have been found are records of kings, or accounts of contemporary events pictured on monuments.

Of the religious literature the most important which survives is the Book of the Dead, a funeral ritual containing prayers, an account of the adventures of the soul after death, and directions for reaching the Hall of Osiris—the abode of departed spirits. In the chapters on the history and architecture of Egypt you can read more about the beliefs of the ancient Egyptians.

We have about eighty letters on various subjects, dating from the time of Rameses, which give us a good idea of the style and manners of that age. Some of these are in the British Museum. In fiction there is The Tale of Two Brothers and The Romance of Setna. There are some remarkable medical papyri also, which one can see in the Berlin Museum.

The famous Library and School of Alexandria belong to a time when Egypt had passed under the influence of Greece; they are not Egyptian in thought or feeling.

ARABIC LITERATURE IN THE DARK AGES PRESERVED LEARNING

The language in which, apart from the Hebrew, the East has spoken to the world (of course by translations) is the Arabic. There was a time, during the Dark Ages of Europe, when the best learning in the world was written in Arabic. The practice of medicine, for instance, was gov-

erned for five hundred years by the writings of Avicenna, a Persian born at Bokhara in 980, who wrote all his books except one in Arabic; and the Spanish Moor, Averroës, born at Cordova in 1126, influenced greatly the thought of all the Christian world by introducing afresh to its notice Aristotle's system of philosophy. These are examples of literature once world-wide in its power, but now known only to the special student.

An Arabic book that still has a wide circulation throughout the civilized world is The Thousand and One Nights. This treasury of romance and adventure which illustrates the Eastern custom of story-telling, is now pruned and altered so as to be an amusement for children, who know it as The Arabian Nights' Entertainments. It has no known author, but is a collection of tales from many sources in lands where the spoken story is the commonest form of amusement.

The book of books in Arabic throughout the whole of the Mohammedan world of over two hundred million believers is the Koran. It may be questioned whether any other book in the world is as well known by as many people as is the Koran. More probably know the Bible in some degree, but what they know of it is usually not known as well as pious Mohammedans know the Koran.

The influence of the Jewish Scriptures on Mohammed

No other book claims to have a similar origin in as simple a manner. Mohammed was an epileptic poet with the intensest belief in his own inspiration. Whether he could read or write is doubtful. When he began his mission, knowledge of Christianity and the Jewish Scriptures had been spreading in the East for over five and a half centuries. His knowledge of them was probably gained by hearsay, as was then customary in the East with all forms of knowledge. The Arabs generally were superstitious idolaters. Mohammed was deeply impressed by the Jewish belief in One God, and he had heard of prophets who proclaimed with fervor that idea. To a similar proclamation he devoted his life, believing he was inspired as other prophets had been.

He imagined the Almighty Creator as great and remote, but all-merciful and compassionate, and that an angel came to tell him the Divine Will.

The message given in these angelic visitations he at once dictated, often just as he had emerged from an epileptic fit, to an attendant scribe, who wrote them down on any writing material he had at hand. These messages, continuing for years and covering many of the practical affairs of Arab life, as well as religious exhortations, formed the Koran when they were finally collected. For this book, therefore, it is claimed that it is a direct revelation to a single prophet, and it is regarded by the devout Moslem as an all-sufficient guide.

Viewed as a piece of literature produced in strange circumstances, often in the midst of dangers, by an ignorant but clever man, the Koran has no equal. It has lofty ideality, genuine poetry and true eloquence, mixed with childishness, Eastern sensuality, and frequent contradictions.

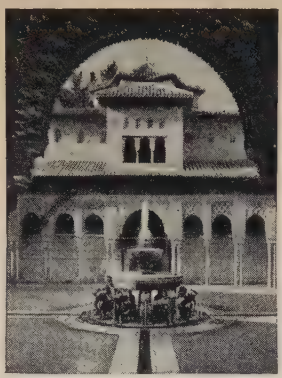
The literature of the remarkable Hebrew race

The Bible, which, at a distance and through hearsay, prompted Mohammed to produce the Koran, is entirely different in character and origin. Instead of being one book written by one author during a continuous period, it is a collection and compilation of many writings widely separated in time and character. These writings have been frequently edited and combined. The thread on which they are strung, until the later parts of the New Testament are reached, is that of nationality—the story of the Hebrew race and its relation to the idea of One God. At first this God was of a tribal character, but the belief broadened out under the insight of the prophets, until the final universal God of the New Testament is pictured. There is a Bible chapter earlier.

The remarkable Hebrew race has a very extensive literature of its own, apart from the selected writings which have been placed from time to time in the Biblical collection. Its religious expositions are expressed with keen controversy in the Talmud. The Apocrypha is one of the choicer illustrations, and there is a mass of Apocalyptic writings of which only one example, the Book of the Revelation, has been chosen for inclusion in the Bible. A historian of the more modern kind, Josephus, may also be mentioned. He was a Jew who won the confidence of the Roman authorities, but he never abated his zeal as a sympathizer with his race.

THE NEXT STORY OF LITERATURE IS ON PAGE 5747.

Decorated arches in the Alcazar at Seville.



The Fountain of Lions in the Alhambra.

In the Court of the Fishpond in the Alhambra.

THE EASTERN BUILDERS

WE might call the greatest architecture in the world that which has overcome the greatest difficulties of construction and at the same time has attained nearest to perfection in beauty of form.

The Greeks accomplished this; but we must remember that their constructional problems were few. With flat-roofed buildings of one story only, the chief problem they had to meet was the placing of a sufficient number of columns in the exact position to support the roof.

The Romans overcame the next difficulty in construction: the use of the arch and the throwing-up of successive stories. As for beauty of form, as we have seen, they borrowed from the Greeks. What they had begun the successive powers of Europe developed.

In the meantime, in the Near East a new architecture was rising; it spread over Asia and also took root in Spain. This style has been called Mohammedan, Arabic, Moorish, Saracenic. The last is preferred by historians, as the architecture owed its birth to an event in the land of the Saracens. During the first few hundred years after Christ some wandering tribes were living in the Arabian desert without any special home. As time went on they came to be known as Saracens or people of the East. To them in the year 570 was born a man called Mohammed who shaped the religion—based on the writings of the Koran, which he put together—that bears his name. The beliefs of Mohammed were accepted with great fervor by his people, and there grew up among them a passion to conquer the world and convert it.

These homeless desert people were not only natural fighters, but carried swords sharpened by their zeal. They overran Persia, Mesopotamia, Syria, Palestine, Egypt, North Africa, Spain; they threw an outpost of their empire as far as northern India. Wherever they went they established an architecture which, though different in every country, yet had a family likeness.

In more ways than one Saracenic architecture was a peculiar growth. As far as sacred buildings were concerned, it was not so much an architecture of temples as of houses of prayer. The Mohammedan places of worship lacked the very heart and core of an ancient temple—the shrine where the figure of the god was set. They were simply buildings where people gathered to pray, their faces turned toward Mecca, their holy city. A little niche in the wall, called the Mihrab, indicated the direction of their city.

One of the laws of the Koran forbade any display of the human figure or animal forms in sculpture or painting. This restriction was the cause of the development of a brilliant geometric or fanciful ornament in flowing, fine lines, which still exists in architecture to-day under the name Arabesque. These religious buildings—mosques, they are called—were at first very plain structures; they might be described as square spaces roofed in, where people could gather to worship. In their early history the roofs were flat; later the dome appeared, generally indicating the place of a tomb.

The characteristic features of the finest Saracenic religious buildings are the pear-shaped, or pointed, domes, and the tall, strange minarets, or towers, where the priests mounted at appointed hours to summon the world to prayer. Their greatest beauty was in the interiors, and in this they resembled the Egyptian temples, whose gaunt exteriors gave no hint of the grandeur of the hypostyle hall within.

THE ELABORATE ARCHES IN THE ARCHITECTURE OF THE SARACENS

The mosque walls were decorated in every possible space. Restraint, that keynote of great architecture, was unknown to the Saracens. They had a passion for arches, and the more ornate, the happier they were. They used the pointed horseshoe, the ogee (like a round arch running up in a reverse curve to a narrow point) and others more elaborate.

Arch after arch, rank on rank, as if they had been forest growths, rose up in their buildings. The richness of display, the illusion of countless lines and curves was helped by their peculiar arrangement, which is described as stalactite vaulting. Their arches which vaulted the ceiling ran up from the supporting pillars in a series of small pointed shapes, or niches, rising up one above another, and giving a honeycomb effect. This makes a peculiarly interesting feature of the Saracenic dome.

The architects presently had a great love for this honeycomb treatment of a surface, and used it freely as a decoration for capitals of columns, or to fill in spaces on exterior walls.

These builders were very ingenious in what might be called their architectural conquests. In each country they conquered they made use of existing styles and adapted them; so that we have Egyptian Saracenic, Spanish Saracenic, Indian Saracenic, and so on. There was an Eastern and a Western capital, both political and religious, of this strange, scattered dominion. One was at Bagdad, in Persia, the other at Cordova, in Spain.

THE LOVELY TOWERS WHICH MARKED THE GRANDEUR OF THE MOORS

The phrase "the Moors in Spain" denotes the period of Saracenic rule, from about 710 to 1492. These centuries were marked by the growth of a remarkable architecture. It cannot be called great because more attention was paid to surface decoration than structural beauty. But, on the other hand, this Saracenic spirit produced, among other things, the wonderful Giralda at Seville, one of the most beautiful towers in the world.

Every now and then the Saracens built towers like this, for no purpose at all, it would appear, save to point a finger to the glory of the Mohammedan conquerors. Apart from their appreciation of the towers as symbols of their grandeur, they must have loved them. The minarets of the East were never as beautiful as these separate towers which arose here and there, as in Morocco and Tunis.

When we look at the Giralda we first have to forgive the meddling architects of the sixteenth century who were pleased to put a Renaissance belfry on the top of the Saracen tower. The two styles are not akin, and only the great beauty of the body of the tower saves the Giralda from being spoiled. We can see on the walls of the tower the rows of toy arches and panels of honeycomb ornament, and the contrast makes us appreciate the unadorned spaces that support and frame the decoration.

THE WONDERFUL ALHAMBRA BUILT BY THE MOORS IN SPAIN

To Spain also belongs another very famous building, the best known of all erected by the Saracens—the Alhambra, or Red Palace, at Granada. It was begun by one of the caliphs early in the fourteenth century and variously added to during the next two generations. The prince who planned it was a great architect and had already set up mosques in Palestine. Here he seemed to want to build something that should be the mirror of Saracen greatness and of his own glory.

Like the rest of the architecture of the Mohammedan people, the Alhambra was not built so much for permanence as for lavish display. Many of its pretty arches

The Court of the Lions in the Alhambra at Granada.

Wonderful arches in the Great Mosque at Cordova—perhaps the finest mosque outside of Egypt.

A window in the Hall of the Ambassadors in the Alhambra.

were shams, in that the weight which they should bear was already supported by lintels. The arches were merely set there to look nice. A greater sin against architectural laws could scarcely be imagined. And yet, although our reason is offended, we cannot but respond to the strange charm of these Moorish buildings. They cast a spell across our present work-aday life.

THE QUIET COURTS OF THE ALHAMBRA INCLOSED IN THE RANKS OF ARCHES

Had the proud caliph of the West builded less proudly and more wisely, we should not now be deploring the crumbling of his palace fabric and the loss to the world of a singular beauty whose spirit can never be recaptured.

The Alhambra was more put together than planned. Its halls and apartments, among them the famous Hall of the Ambassadors in the Comares Tower, clustered about two large courts, which were set at right angles to each other and were inclosed in ranks of arches, single and double, their pretty honeycombed shapes rising from slender columns. One of these quadrangles was called the Court of the Lions, and the other the Court of the Fishpond.

The love of the Saracens for parallel lines of opposing colors, for the interweaving of Arabic inscriptions in the ornament of a building, for wall decoration in gold and rich tints, is very clearly shown in their Red Palace at Granada. The huge mosque at Cordova shares the glory of the Alhambra in that it is the finest religious building set up by the Moors in Spain—perhaps the finest mosque outside of Egypt.

THE ROMAN INFLUENCE IN THE MOORISH MOSQUE AT CORDOVA

None of the Spanish mosques was domed. The Cordova mosque is a remarkable building, only thirty feet high and covering an immense area. It was built five hundred years earlier than the caliph's palace, and showed the Saracens' skill in adapting their buildings to architecture already existing in the countries they conquered. Roman columns and round arches and Roman capitals were used, along with those of Saracenic design, and Byzantine mosaics paved the mosque floor. The interior of the church is especially rich in color, and was made radiant by numberless hanging lamps.

Of the mosques of varying importance, grandeur and style, which mark the path of the Mohammedan conquest, the finest are in Cairo; of these, the Kait Bey mosque is generally considered the most beautiful. Others, whose fame is more historic and sentimental than architectural, are the Mosque-el-Aksah and the Dome of the Rock—the so-called Mosque of Omar—at Jerusalem, the Great Mosque at Mecca and the Great Mosque at Isfahan, in Persia. Two fine mosques which bear the names of their founders, Suleiman and Ahmed, are at Constantinople, and are Byzantine in character, being planned in imitation of St. Sophia.

It is very interesting to note that during the Saracenic rule in Egypt some of the caliphs showed an inclination to adopt the idea of the Egyptian tomb-house. A few of them erected buildings in Cairo of an ornate style which were lightly used as pleasure houses and afterward served as their tombs.

WHY THE SARACEN BUILDINGS WERE NOT MADE TO LAST

In India also this happened, as we shall presently see. But, generally speaking, the Mohammedans' absorption in the present was too strong to admit of any great interest in a future state. The Saracens were content to use flimsy materials which they knew could not withstand the wear of many generations. So did their fatalism, their constant "Allah's will be done," paralyze the intelligence of a very gifted people.

One or two tombs proper still remain here and there in the lands the Saracen conquered, and to boys and girls of all ages the most important is that of the Lady Zobeide, wife of the Caliph of Bagdad, Harun-al-Rashid. The tomb, an eight-sided building with a queer, pyramidal roof, was set up when Bagdad was in her glory. Harun lived only from 786 to 809, but he is immortal through the glamour of The Arabian Nights' Entertainments; and no one will ever forget Zobeide, whom he loved.

When the Saracens overran India, about the year 1000, they found, for the first time in their conquests, an architecture for the most part more casual, more indifferent to constructional laws than their own—an array of temples of fantastic and grotesque appearance. The architecture of early India, like that of the Saracens, stands apart from the world's story. Nowhere does it mark the scale

EASTERN BUILDINGS IN SPAIN AND INDIA

The Rashmanie Temple in Calcutta.

The Giralda Tower at Seville.

A porch in a court of the Alhambra.

A hall in the Alhambra.

of progress from one stage of advancement to another, as in the case of Egyptian, Greek and Roman work. It leads nowhere save into the blind alley of its own ideals. And yet we cannot pass this strange architecture, on which generation after generation expended its energy, without a thought for its qualities and an attempt to understand its workings.

THE GREAT MOUNDS THAT WERE SET UP FOR THE RELICS OF SAINTS

It was, as we may expect, an architecture of religion, and is best grouped under the headings of the different faiths that have been held in India in historic times.

Buddha preached his gospel in the fifth century before Christ. When, some three hundred years later, Buddhism became the religion of the various races who peopled India, its architecture began to develop. Relic-worship became a strong power and gave rise to the great mounds called "topes," built for receiving relics of saints. Some of these still exist, like the Sanchi Tope and others in central India—huge round masses of brickwork raised on platforms, with a processional path round them, and on the top of the mound the "tee," which contained the saint's relics.

An elaborately carved rail, which looks like stone imitating wood, ran round the sacred inclosure, with huge gateways whereon is some of the earliest picture-carving of the Indian artists. A model of a tope can be seen in the South Kensington Museum in London. Here and there carved and inscribed columns called "lats" are set up. A fine one is at Allahabad. This early carving was of an individual nature, already foreshadowing the wealth of odd decoration that was to come.

THE MASSIVE TEMPLES OF BUDDHA CARVED OUT OF THE SOLID ROCK

The temples of Buddhism were carved out of the solid rock in the mountain-face, and therefore have only one outer front. Through square openings and under great carved columns the worshipers passed into the gloom of the interior, in whose farthest depths was the sacred shrine. A great amount of work was spent on hewing out the roof and aisles of these gaunt places. The result was very impressive. Rows and rows of massive columns with carved capitals and surmounting sculptured forms flanked the shrine. The outer wall, where the entrance openings were hewn out, presented a strange aspect, with its long lines of carved shapes, the familiar seated Buddha-form being endlessly repeated. An enormous opening, horseshoe-shaped, was carved out above the level of the doors, to let light into the shrine, and this gave a curious top-heavy look to the temple front.

The finest of these rock temples are at Karli, Ajanta, Ellora and Elephanta, on the Western Ghats.

Jainism, which was contemporary with, or earlier than, Buddhism, produced a strikingly different temple architecture. Instead of being cumbrous gloomy places carved out of the rock, theirs were radiant white marble piles flung up on the mountainside. In northern India this architecture was the strongest, and here temple after temple arose in shining splendor to witness to the Jain faith.

THE FANTASTIC CARVINGS WHICH COVER THE WALLS OF JAIN TEMPLES

Mount Abu was holy ground to the Jains, and there they built a cluster of these temples. The two most famous of a great array are the Dilwarra temple and that at Ranpur. On these interiors it seemed that architects and sculptors set themselves to work for their own delight and without any regard to unity or proportion. The instinct for grotesque decoration was forming, and presently overgrew, like a fungus, the architecture of India.

Outwardly, and from a distance, the Jain temples were very fine and had an air of semi-classic simplicity, with their great columned porticoes and mounting shapes. Close at hand you could see how the wall spaces were endlessly carved. In the interiors—wonderful colonnaded aisles and shrines—it would seem that a host of sculptors had been turned loose, each a little mad, all dreaming, and these in their dreams had carved and carved till not a square foot was without its fantasy.

This wealth of minute decoration was very pleasing to the Indian people, who cared nothing for proportion and construction, and only for the effect of the white sculptured columns, domes and walls. And the spirit of Jainism fostered this lavish display, as it was essential that each temple should contain a number of idol-cells wherein was sculptured the statue of the saint to whom it was dedi-

cated. The more idol-cells in the fabric of the building, the better the saint was thought to be pleased. In some cases they numbered hundreds.

Each of the twenty-four Jains, or saints, had an animal symbol which was always carved above the saint. Hence the profusion of animal forms and other mysterious symbols that filled the temples of this religion.

How Hindu Architecture Expresses Brahmanism

The rise of Brahmanism in turn brought its changes, and the architecture generally known as Hindu arose. The great temple, Bhuvaneswar, on the eastern coast, is sometimes called the finest building of this class. A very famous one is close by, at Puri. All over India rose the Brahman temples, each most profusely sculptured, each entailing the lifetime work of many hundreds of men, by whose energies the deities, it was supposed, were well pleased. There were many styles among them, different shapes of entrances and different kinds of sanctuaries, roofs and columns. But over them all spread the fantasy of the sculptor—the most important element in the building.

In southern India rock-hewn temples arose, at a later date, of a different kind from those of the Buddhist Order, in that they are completely hewn out of the rock and stand as one solid, fantastic mass. This Dravidian architecture, as we call it, seems to summarize the Indian style of decoration. Around the walls, which appeared to crouch and cling together, ran layer after layer of most finely wrought sculpture, some of it just curious symbolism barbaric and rather revolting to our matter-of-fact minds.

The Decoration of the Sculptor Spoiled the Work of the Architect

This decoration was always controlled by horizontal base lines. It is as if the sculptors began at the bottom, and when they had been all round the temple once, they cut a deep horizontal line and went on again, on the next layer, all round the temple walls; and on and on.

The horizontal effect thus obtained was very characteristic of a great part of Indian temples. The sculptors seemed to undo the architects' work. When walls and pyramidal roofs had been planned and thrown up for a great height, this effect of height was immediately destroyed by the horizontal lines of the sculpture.

The Saracen invasion brought a certain purity into this land of exuberant art, a breath of clearer air, a style that was at once nobler and more sane. When Delhi was made the capital of Mohammedan India a new architecture arose. Probably the most famous early building in this city which became so rich in lovely things was the Kutab Mosque, erected at the end of the twelfth century. It was built of white marble and red sandstone blended, with domes and colonnaded courts. Within the precincts rose a huge tower known as the Kutab Minar, one of the finest the Saracens erected. A model of it is in the South Kensington Museum, London. There we can see its delicate beauty and try to imagine what it looked like towering above the roofs of ancient Delhi.

How Indian Architecture Developed in the Sixteenth Century

The Kutab Mosque is only one of a number that marked the first centuries of Mohammedan rule. Later, in the sixteenth century, came the finest Indian Saracenic architecture, which was developing on simple and grand lines, leaving behind much of the casual prettiness of the Western buildings. Marble and decorative stone freely quarried in India inspired a more imposing and severe style of buildings, and as the Saracens' love of exquisite finish in detail was helped by Hindu workmen, a very fine architecture was the result. Palaces, halls, mosques and tombs arose all over India.

One of the Mogul rulers, Shah Jehan, was a great architect, and found time during his stirring reign to set up certain buildings which have carried his name and fame down over the stormy centuries of Indian history to our own day. He was the founder of the modern Delhi, which to the Mohammedan is still Shah Jehanabad—the city of Shah Jehan. There he built the Jama Masjid, a mosque of fine proportions, and at Agra the building known as the Pearl Mosque, which is in white marble and very beautiful.

Shah Jehan built at Delhi one of the greatest palaces, planned in the most royal manner, the world has ever known. Only fragments of it remain, overrun by British military buildings. To the romantic-minded this ruler's greatest work was the exquisite Taj Mahal, at Agra. This tomb-house, erected in honor of the wife he so loved, was the finest flower of Shah

Jehan's rich imagination. It is built in perfect proportion and marvelous taste.

THE LOVELY TAJ MAHAL, IN WHICH A LADY SLEEPS

The Taj Mahal stands on a platform eighteen feet high and over three hundred feet square, with a minaret at each corner of the platform. From the middle of the building rises the pear-shaped dome of the Saracens, and four small domes cluster round it, like buds round a flower. The builder seemed to know that in raising this mausoleum he could not afford to deviate an inch from its symmetrical plan without losing something of its charm. On the perfect shape of the white marble mass the Saracen artists laid their jewel-work in many colors. Marble terraces and beautifully inlaid walks lead up to it; dark sentinel trees make an exquisite contrast to its whiteness and light; the waters of Jumna River glide gently by, as if to soothe into eternal rest the human life and love consecrated in the Taj Mahal.

The days of the Great Moguls in India were marked by architecture which within its own style was superb; buildings like the Mosque and Diwan-i-Kas at Futtehpore Sikri and the Sikandra Tomb, erected by Akbar, the grandfather of Shah Jehan. For some time the tradition of excellent building was maintained, long after Shah Jehan followed his lovely wife to the grave. But, like all great movements, Mogul architecture, the finest expression of the Saracens in the East, topped its heights and sank. There has been nothing really great set up in India since.

THE CHINESE BUILDINGS, WHICH SEEM TO BE NEARLY ALL ROOF

The architecture of China, changeless through many centuries, presents an aspect to the Western mind which can best be called quaint. The Chinese, like the Japanese, who modeled their buildings largely on the work of their neighbors, were artists in surface decoration rather than in building form. Had they not needed houses and temples they would never have built anything. Whereas one feels with the Greeks and Normans that if they had not had the excuse of temples and halls and houses they would have found another reason for setting up their lovely shapes in marble and stone.

The chief note of Chinese architecture is the roof treatment. When their builders wanted height they laid on roof after roof, with their peculiar upward-curling, leaf-like corners, all elaborately decorated, till they had attained the size they desired. Their palaces, like that of the emperor at Peking; their temples, like the famous Confucian Temple of Heaven at Peking; their towers, or pagodas; their *pai-lous*, or gateways—all depend on upward-curling eaves for character. The Chinese artists and architects seemed to be quite happy if they were given walls and shapes to decorate according to small, natural forms. They had the kind of vision that sees constant details and is happiest when these details multiply on each other, like leaves on a tree. This vision makes excellent embroidery, perhaps, but does not produce architecture.

THE GREAT WALL WHICH STRETCHES ACROSS CHINA FOR 1,400 MILES

Confucianism produced no great temples, as it was a scheme of moral laws and had no priests. So that the tale architecture tells is silent during many centuries in China. And when Buddhism came in force, in the first hundred years after Christ, the Chinese, having no tradition of temples, probably could not see any reason for starting building them in great numbers. That they could construct when they wished we know from their bridges and from the Great Wall which, with its towers and remarkable masonry, runs up hill and down dale for some fourteen hundred miles. The spirit of the Great Wall is Chaldean.

The pagoda is probably the most essentially Chinese in spirit of all the buildings of the Celestial land. Its idea may have been borrowed from India, but its treatment is the most Chinese thing in China. It is often a memorial building, and not connected with a temple or a monastery. The commonest form is an octagonal tower with an elaborately curved roof.

The Japanese buildings—temples, pagodas, tombs, palaces—are of the same class; a little daintier, lighter, more flower-like, as one would expect from a people living in a miniature land, who are artists in decoration based on natural forms. Although they endeavor to secure their buildings against earthquake shocks, they are never safe from destruction, as their history has told from time to time, and most lamentably again not so very long ago.

THE NEXT STORY OF THE FINE ARTS IS ON PAGE 5715.

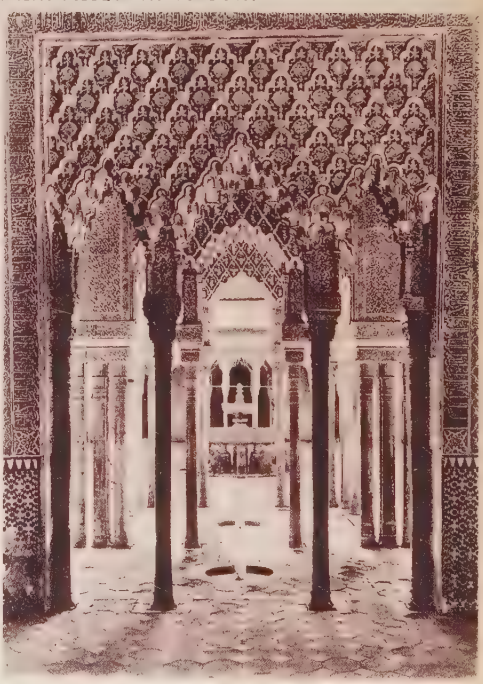
TYPICAL EASTERN ARCHITECTURE

THE SPLENDID BUILDINGS LOOKING OUT ON THE COURT OF LIONS IN THE ALHAMBRA

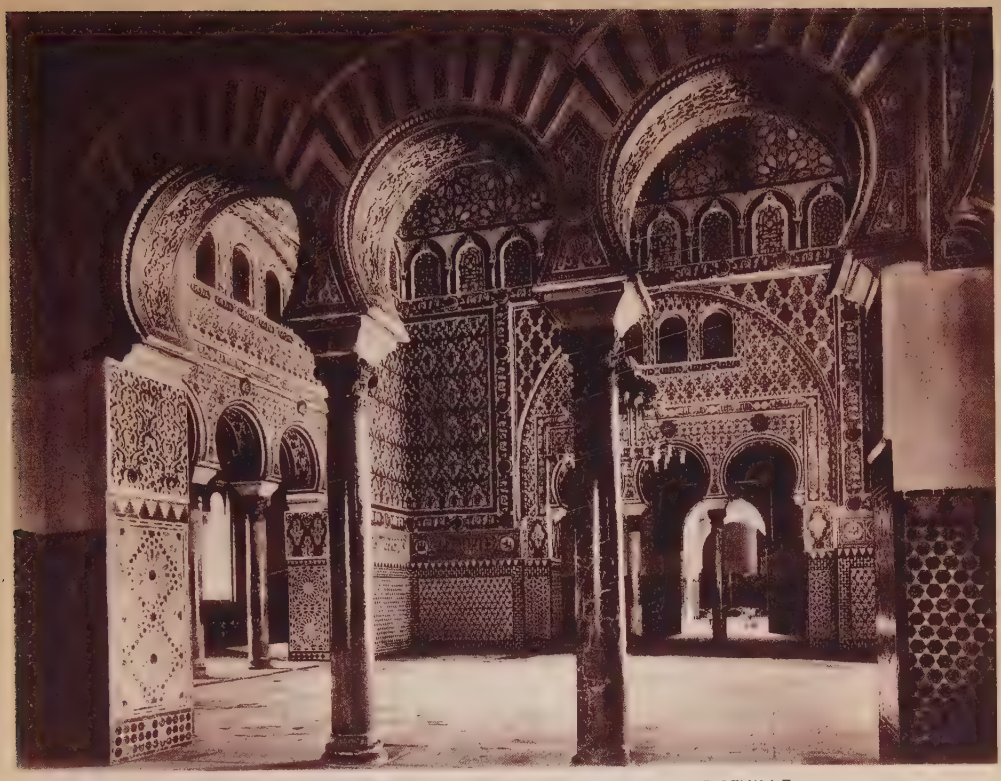
THE ENTRANCE TO THE KING'S SLEEPING APARTMENT IN THE ALCAZAR AT SEVILLE

COLUMNS AND ARCHES OF THE GREAT MOSQUE AT CORDOVA

THE HALL OF THE TWO SISTERS
IN THE ALHAMBRA

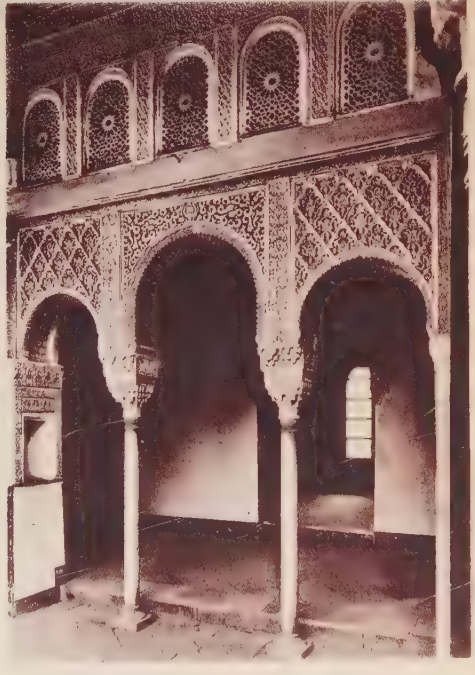


ARCHES LEADING TO THE COURT OF THE
LIONS IN THE ALHAMBRA



THE HALL OF THE AMBASSADORS IN THE ALCAZAR AT SEVILLE

THE KING'S SLEEPING APARTMENT
IN THE ALHAMBRA



A PORCH IN THE SUMMER PALACE OF THE
MOORISH KINGS AT GRANADA

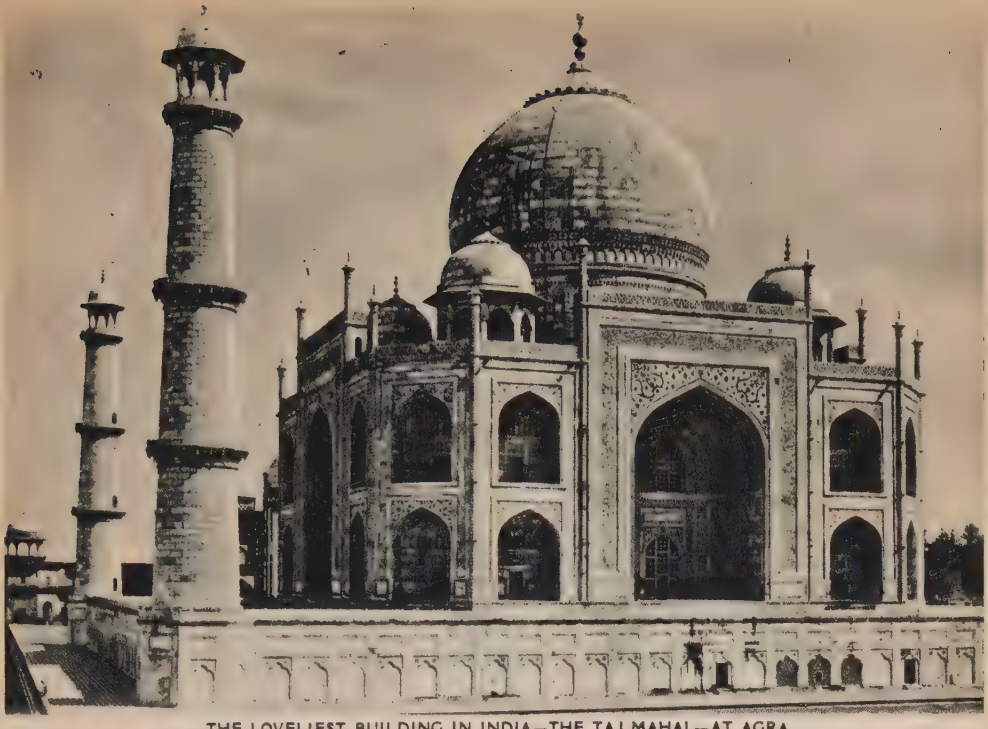
THE FAMOUS MOSQUE OF OMAR AT JERUSALEM

ARCHES IN THE INCLOSURE OF THE MOSQUE OF OMAR

BEAUTIFUL MOSAICS ON THE MOSQUE OF OMAR

THE COURT OF THE FISH-POND IN THE ALHAMBRA

A COURTYARD IN PILATE'S HOUSE AT SEVILLE



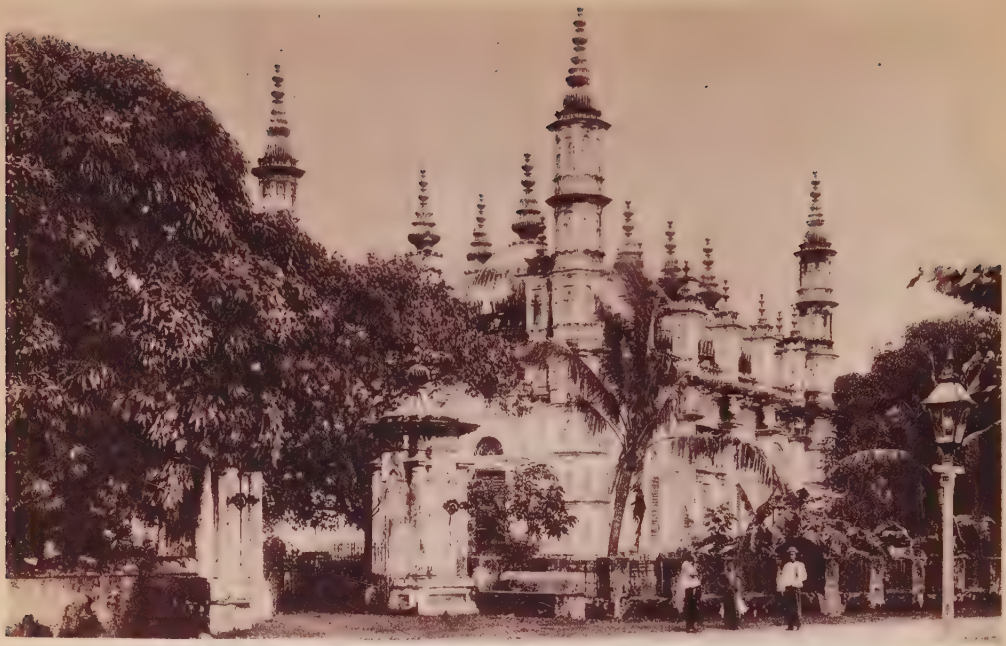
THE LOVELIEST BUILDING IN INDIA—THE TAJ MAHAL—AT AGRA

AN APARTMENT IN SHAH JEHAN'S PALACE AT DELHI

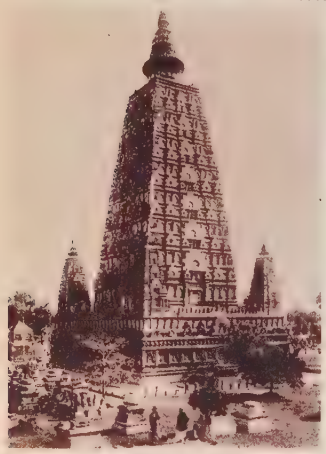
SCREEN AROUND THE TOMBS IN THE TAJ MAHAL

THE WEALTH OF CARVING INSIDE THE GREAT MOSQUE AT CORDOVA

IN THE HALL OF THE AMBASSADORS IN THE ALCAZAR AT SEVILLE



THE SPLENDID MOSQUE AT AKYAB, IN BURMA

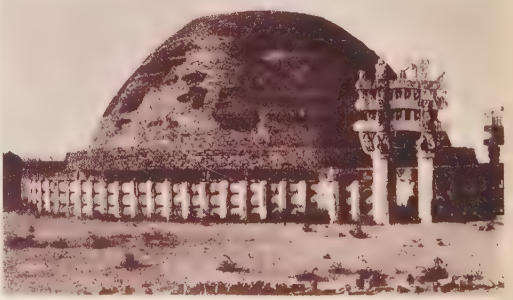


BUDDH-GAYA TEMPLE, NEAR PATNA

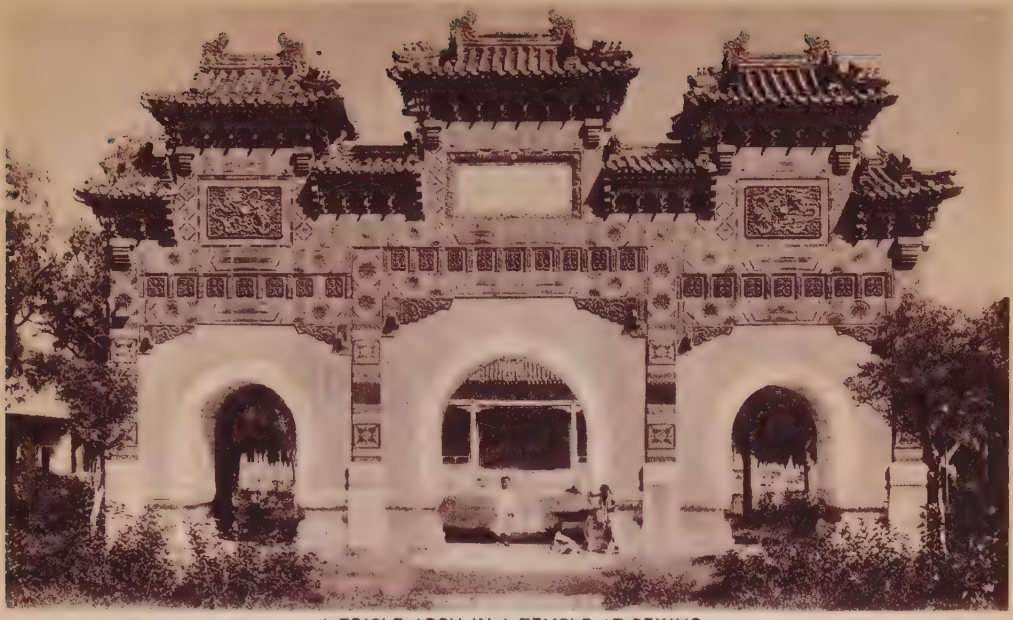
A ROCK TEMPLE AT ELLORA, IN INDIA

CARVING ON THE KUTAB MINAR AT DELHI

THE JAMA MASJID AT GWALIOR



THE SANCHI TOPE IN CENTRAL INDIA



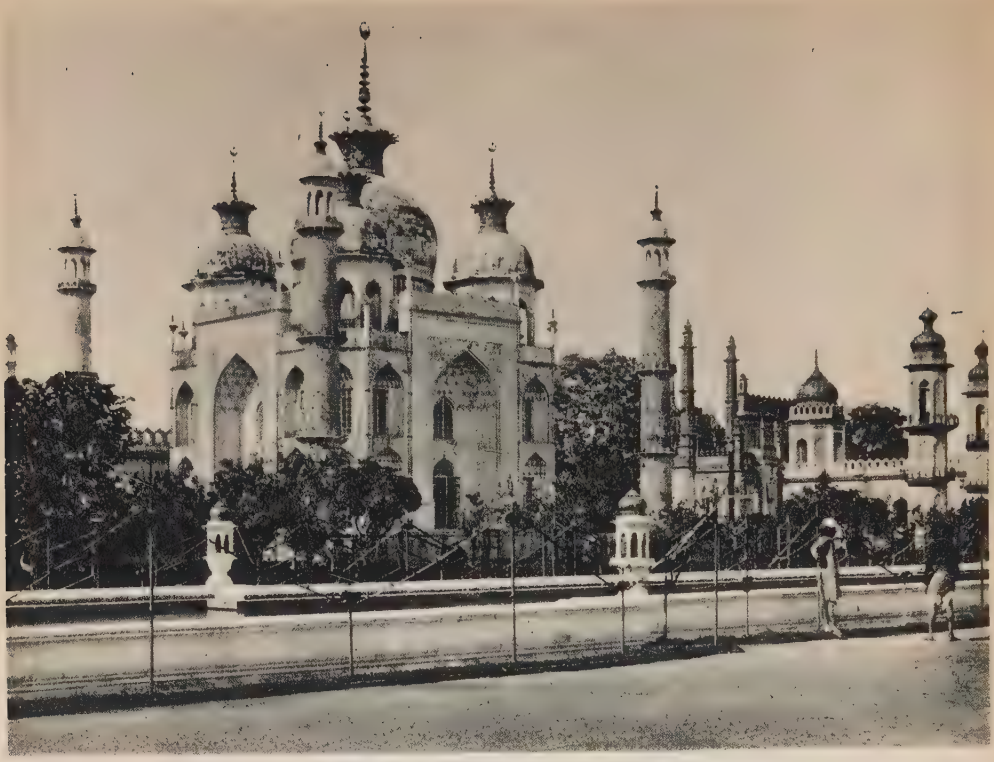
A TRIPLE ARCH IN A TEMPLE AT PEKING

THE UMBRELLA PAGODA AT PEKING

THE CARVED DOORWAY OF SHWEE ZEEGONG TEMPLE IN BURMA

THE LOONG WAH PAGODA NEAR SHANGHAI

THE MARBLE ARCHES AT THE MING TOMBS IN CHINA



THE TOMB OF ZENAB ALIYA AT LUCKNOW

THE ZENANA IN FORT AGRA

A RUINED INDIAN TEMPLE AT AHMEDABAD

The pictures in these pages are by Messrs. Anderson, Bourne & Shepherd, H. G. Ponting, and others.

Dr. Robert Koch.

Sir David Ferrier.

Sir Ronald Ross.

Sir Patrick Manson.

Sir David Bruce.

Elias Metchnikoff.

Dr. Walter Reed.

Professor Behring.

Sir Victor Horsley.

Dr. Paul Ehrlich.

CONQUERORS OF DISEASE

IN the olden days students of medicine studied with practicing physicians. Often these students were college graduates, but often they were not. When laws were made declaring that all students of medicine should attend a medical college, too often the teaching in these medical colleges was very narrow. The fact of the matter was that all it was thought necessary that a student of medicine should study was anatomy, the symptoms of diseases, and the medicines needed to overcome the ravages of illness. Most of them, of course, were what we call cultivated men. Many of them were learned in subjects which did not seem to have much reference to the science of medicine; but this was not thought necessary to their usefulness in their profession.

A change from this way of thinking came in the nineteenth century. In our day a student of medicine knows that he must study the laws of every science that has to do with life in any form, no matter how lowly. Moreover, the best doctors have learned to believe that the chief use of medical science is to teach people how to obey the laws of health so that they may keep well. In other words, they believe that it is easier to prevent illness than to repair the hurts that it has caused. Before they came to this point, doctors had to learn the cause of illness. The men of whom we have told you on page 2721, learned a great deal about the anatomy of the human frame, but they did not know much about the causes of illness, and the story of those who learned how to gain this knowledge is the story that we shall tell you here.

LOUIS PASTEUR, WHO LEARNED THE IMPORTANCE OF MICROBES

Strangely enough, Louis Pasteur, the man who first found the pathway to this new knowledge, was not a doctor of medicine, but a chemist. He was born in a little French town called Dôle, in the valley of the Saône, where his father, who had been a soldier in Napoleon's army, had settled down to his work as a tanner. While Louis was still very young his father and mother moved to Arbois, where there was a good school, which he attended. Afterward he went to the college of Arbois. There the director advised him to prepare for the great Ecole Normale, or normal school, in Paris, so that he might become a professor in one of the great colleges in France. His father and mother were determined to give him all the advantages they could, and when he was sixteen

Louis was sent to Paris to prepare for the Ecole Normale, but he was so homesick that he fell ill and had to go home again. Then he went to the Royal College at Besançon, where he took his Bachelor's degree in literature. After he took his degree he was made an assistant teacher in mathematics.

While he taught he prepared for the examination necessary to admit him to the Ecole Normale. The professor in chemistry at Besançon, who was an enthusiast in his science, roused Pasteur's interest in it. However, when he went up for his examination at the Ecole Normale, he got a pass only on his chemistry examination, and was so little satisfied with this that he refused to accept it. He went to Paris for a year's study, entered for the examination again the next year, and this time his name appeared fourth on the list. During this year of study the influence of J. B. A. Dumas, whose lectures he attended at the Sorbonne, induced him to devote himself to chemistry. He entered the Ecole Normale in 1844 and three years later took his degree in physical science.

Pasteur becomes a teacher of science

In Paris, where he was appointed assistant in the laboratory at the Sorbonne, he made his first great discovery. A chemist named J. B. Biot had made experiments which led to discovery about the effect of light on the crystals of tartaric acid. Pasteur in his study of the crystals completed the discovery and finished the work that Biot had begun. The discovery was very important, and when the experiment was carried out in his presence Biot cried out: "My dear child, I have loved science so well throughout my life that this makes my heart beat fast."

As a result of this discovery of what he called "left-handed tartrates," Pasteur was made professor of chemistry at Strassburg. Soon afterward he married Mademoiselle Laurent, who made him very happy in the life that they spent together. It was a very busy life, for the young professor constantly lived up to his motto, *"Travailler, travailler toujours"*—"Work, always work."

The microbes which cause fermentation discovered

A few years after his marriage he was made dean and professor of science at the University of Lille. Though he had much teaching to do, he still went on with his search after the true answers to puzzling questions. One day he paid a visit to a brewery at Lille, and while he was there he became interested in the question, Why does beer turn sour? It was a question which had puzzled many wise men for centuries, but Pasteur answered it. We cannot possibly follow him through all the steps that he took and the long hours that he spent in his laboratory before he found the answer. It is enough to say that, helped by the experiments he had already made with tartaric acid and fermentation, he found that beer and wine and milk are turned sour by the action of living organisms called microbes, and that these microbes swarm in the air around us. "Keep your air free from microbes or keep the microbes from your vats," he said, "and your milk and wine and beer will not turn sour."

He was now recognized as one of the greatest chemists of his time. He was appointed to an important post in the Ecole Normale, and later on he was made professor of chemistry at the Sorbonne. Meantime he found out the nature of the disease among silkworms that had almost destroyed the silk industry in France. He discovered the microbes that cause cholera, which was exterminating French poultry, and the disease called anthrax, which is fatal to sheep and cattle.

Up to this time the disease called rabies in dogs was a cause of terror, for the bite of a dog that is ill with rabies is certain to produce hydrophobia in man. Pasteur became certain that this illness, too, was caused by a microbe. He did not rest until he found the microbe and discovered a way to make a person who had been bitten, proof against the ravages of this deadly little form of life. A campaign against rabies was immediately begun, and the disease has been almost wholly stamped out in some countries.

Pasteur lived to the age of seventy-three. He was a devout Catholic and found no conflict between religion and science. When he died, in 1895, he was buried in the grounds of the Pasteur Institute, which had been founded for the treatment of hydrophobia. There is also a Pasteur Institute in New York, but happily there are now few cases of this

dreaded disease for treatment in the United States and Canada.

Up to the time that Pasteur discovered the part played by microbes in the fermentation of beer, many had believed that it might have been caused by spontaneous generation, which meant that life could come suddenly into being without cause. Pasteur's discovery quite upset this theory and set the whole scientific world talking, but only one man, Joseph Lister, saw what it meant to human life.

large percentage of patients who had undergone successful operations died, and all the surgeons were in despair. Young Lister believed from the first that some means could be found to stop the cause of all this suffering. But, except in maintaining greater cleanliness, he had made little progress when he heard of Pasteur's discovery of the microbes that cause fermentation. That gave him the clue that he wanted. He had already come to the conclusion that hospital gangrene was caused by microbes, and study with his

LOUIS PASTEUR IN HIS LABORATORY

JOSEPH LISTER, WHO FOUNDED MODERN HOSPITAL TREATMENT

Joseph Lister, whose father improved the microscope, was born in Upton, near London, in 1827, and was five years younger than Pásteur. His family belonged to the Society of Friends, and the youth was educated at their schools and at University College, London. He took his degree of bachelor of arts at the University of London, and stayed on at his college until he had taken degrees in both medicine and surgery.

When, as a young house surgeon, he went into a London hospital, he was appalled by the number of deaths that came from "hospital sickness," or gangrene. A microscope showed him that this was the case.

When he went to Glasgow hospital gangrene was raging, and he set himself to stamp it out. Pasteur's discovery taught him that the microbes which cause gangrene could not grow in a wound unless they had been carried there. At first he believed that they came from the air, so he searched for an agent which would exclude air from wounds, and for this purpose he at first used carbolic acid to form a crust over the wound. Carbolic acid is a powerful antiseptic. It kills microbes and destroys the poison that they produce, but its action on flesh is very severe, and although by its aid wounds were

healed without danger of gangrene, it left ugly scars. Therefore, instead of applying the acid direct to a wound, Lister began to use it as a spray. Through various steps he was led to the belief that the use of carbolic acid was not necessary. He learned that the microbes in fresh, pure air do no harm to a wound. It was the microbes carried to it from the hands, the clothing, the bandages or the instruments used in an operation that did the mischief.

Thus he laid the foundation for what is called "aseptic treatment." That is, antiseptics, or microbe-destroying substances, are not applied directly to the wound. They are sometimes used on dressings, and by their use, and the use of great heat, sponges, bandages and instruments are made sterile.

From Glasgow, Dr. Lister went to Edinburgh University, where he succeeded Professor Syme. He stayed in Edinburgh for about ten years and was then called to the College of London, where he was professor of surgery for nineteen years. In 1896, when he was an old man, he gave up his professorship but went on with scientific study to the end of his life. Some time before he retired he was made Sir Joseph Lister; a short time afterward he was made Lord Lister. In 1895 he was elected president of the Royal Society, an honor that is shown only to the most distinguished men of science. He died in the year 1912, at the age of eighty-five.

THE MAN WHO FIRST FOUND THE X-RAYS

If you break your leg or your arm, or hurt yourself in some other way on the playground or in the gymnasium, the doctor will probably have an X-ray picture taken so that he may be able to see what injury has been done to the bone. If you have an aching tooth, the dentist may have an X-ray picture taken to find out why it aches. These X-ray pictures are wonderful things, but they have become so familiar to us that we have almost ceased to be curious about them. We are still less curious about the man who discovered the X-rays. Nevertheless, he was a great scientist, and he has helped the work of doctors so much that he has a place here.

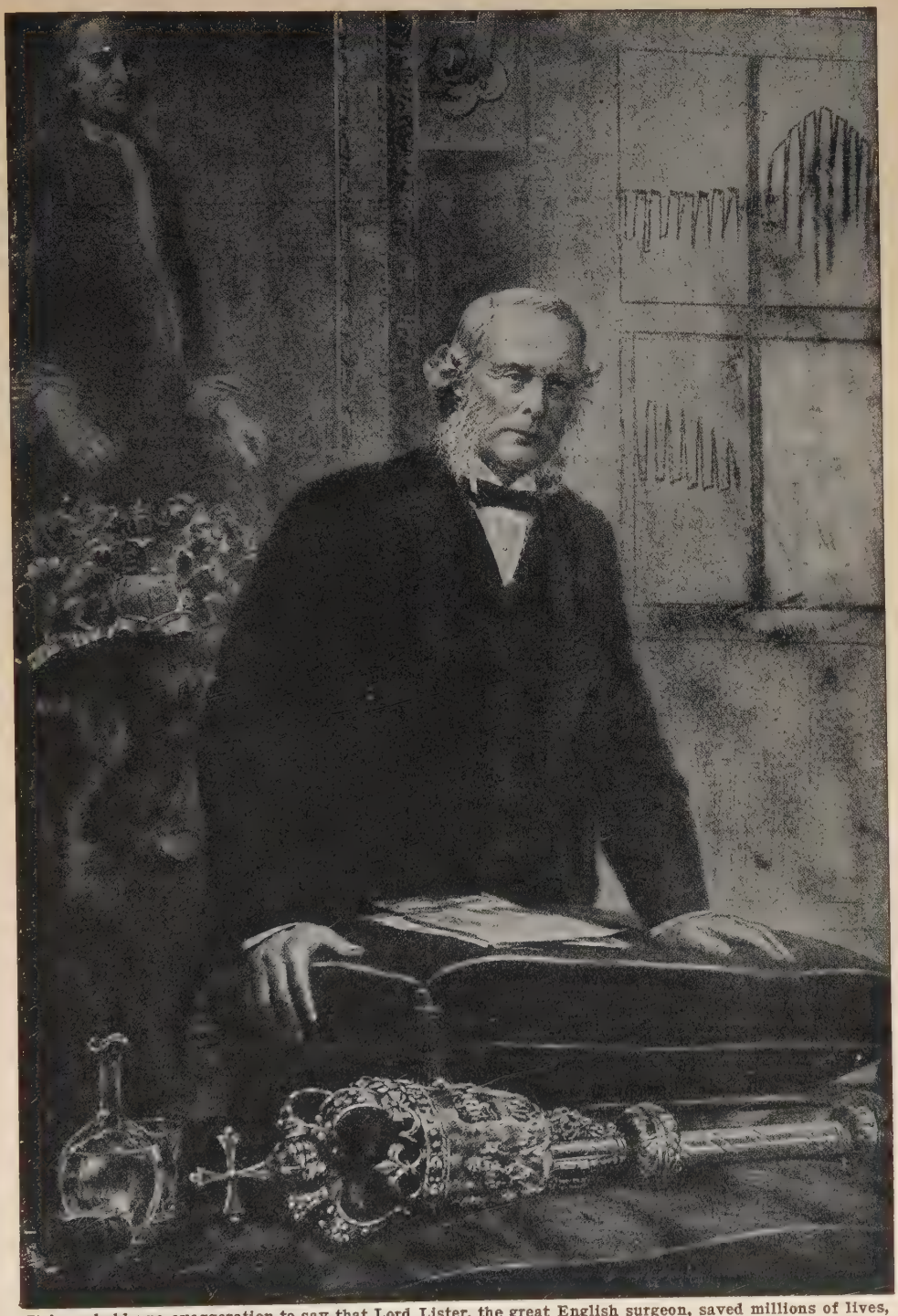
William Röntgen was born in Germany in the year 1845, but was educated in Holland and at the University of Zürich, where he received his doctor's degree at the age of twenty-two. At the university he had turned his attention chiefly to chemistry, and soon made a name for himself in this branch of science. After he took his degree he taught at the universities of Würzburg and Strassburg, and in 1879 was made professor of physics at Würzburg. It was at this university that he made his great discovery. One day, after he had been experimenting with a Crookes tube, he found that he had photographed a key which had been inclosed in a book. This discovery led him on to many more experiments.

The result of his work and study was a knowledge of how to produce the X-rays that physicians and surgeons rank next in importance to the knowledge of anæsthetics and antiseptics. They are used to treat some kinds of growths on the body which are very much like cancer. By their use the doctors can tell whether a badly swollen limb has been broken or has only had a lesser injury. They can find out just how much harm has been done to the lungs by tuberculosis. By making a patient swallow a particular drug which the rays will not pass through, they can in some way find out whether an illness, such as cancer, has injured the stomach or other parts of the body. The rays will show whether or not a bullet has lodged in a wound. Perhaps no one person can imagine all that these mysterious rays did to lessen the pain in treating the wounds received on the battlefields of Europe during the World War.

DR. ROBERT KOCH FOLLOWED IN PASTEUR'S STEPS

One of the greatest of the men that followed in Pasteur's footsteps was Dr. Robert Koch, a German scientist whom we know best in this country perhaps by his efforts to overcome the plague of tuberculosis. Dr. Koch was born in the town of Klausthal, in Hanover, in 1843. He studied at the University of Göttingen, and some time after he took his degree he went with the German army to France during the Franco-Prussian War. When the war was over he settled down as a country physician. As he rode about over the rude country roads to see his patients his mind was busy with many things. He took up Pasteur's work on anthrax, and spent many a long evening over his microscope. Pasteur, as we have read, had discovered the microbe that

THE MAN WHO SAVED MILLIONS OF LIVES



It is probably no exaggeration to say that Lord Lister, the great English surgeon, saved millions of lives, for without his wonderful discoveries many of the operations that are performed in the hospitals of the world would result in death. He showed how the fatal poisoning of wounds, which nearly always followed operations before his time, could be avoided, and the whole world honors him for his splendid work.

caused anthrax and had learned how to prevent the disease. Koch learned the whole life-history of the microbe, and thus taught scientists how to study all microbes.

He also did many things which it is interesting to us all to know. He discovered the microbe that causes cholera, the microbe that causes tuberculosis, and found out a way of preventing typhoid. After he had been made a professor in the Berlin University men from all over the world went to study with him, and many of his students are now carrying on his work. One of these, a Japanese named Kitasato, found out the microbe that causes the bubonic plague, from which so many millions of people have died in Eastern Asia, and which was responsible for what is known in European history as the "Black Death" of the Middle Ages. Dr. Koch went to Egypt to study cholera, to East Africa to find out all he could about sleeping-sickness and a cattle disease called rinderpest, and to India to study the plague. He died in the year 1910.

DR. KOCH, THE DISCOVERER OF THE TUBERCULOSIS GERM, IN HIS LABORATORY

DR. THEOBALD SMITH HELPED THE WORK OF PREVENTING DISEASE

He was helped in his work in typhoid and tuberculosis by the patient researches of Dr. Theobald Smith, who has done so many things and given so many ideas to other men that he might be called the "scientists' scientist." Dr. Smith was born in Albany, New York, in 1859. He went to Cornell University, and after his graduation he took his degree in medicine at the medical college in his native city. The next year he received an appointment from the federal government in Washington, and after a while was made a professor in a university there.

While he was in Washington he found out a great deal about cholera in hogs. The result of his study laid the foundation for all that Koch and other men afterward discovered about the prevention of diseases like typhoid, diphtheria and meningitis. Men and women who are likely to be in places where they may be infected by these diseases are inoculated with vaccines which make their bodies strong against these diseases. This treat-

GLIMPSES OF TWO GREAT HOSPITALS

Bellevue Hospital in New York found that many poor people in the city could not afford carriages to take them to the hospital when they were sick. Therefore, the hospital began to send a conveyance called an ambulance for patients who were very ill. The idea soon spread, and ambulance service is now found in all cities. The picture gives a glimpse of Bellevue Hospital.

Fordham Hospital is built on a beautiful open driveway in the Bronx, a populous and important borough of New York where about three-quarters of a million people make their homes. A hospital such as this, where patients are nursed in large, airy wards, in surroundings of exquisite cleanliness, is a great advance from the times they were shut up in close, airless rooms.

ment, which has been given the long name of anaphylaxis, has saved many thousands of lives.

Dr. Smith found out that the cattle tick, of which we read on page 6019, caused Texas fever. This was a great discovery, for it enabled other men to learn that mosquitoes are responsible for yellow fever and malaria, and the tsetse fly for sleeping-sickness. He also discovered that tuberculosis in man is not quite the same disease as tuberculosis in cattle. Dr. Koch agreed with him in this and for a time thought that the milk of a cow that was ill with tuberculosis could not give disease to a person who drank the milk. Unfortunately Dr. Koch was probably wrong, and at least it is much wiser to run no risk in such a serious matter. Dr. Smith is now at the great Rockefeller Institute, an institution in New York where a band of students are constantly at work striving to find out all about the human frame and the enemies that attack it. At the head of it stands Dr. Simon Flexner, whose work is of particular interest to young people. For years he bent all the powers of his mind toward finding out the cause of infantile paralysis, which has hurt many thousands of children for life, and he found out that it is caused by the tiniest germ that ever has been known.

THE RUSSIAN DOCTOR WHO TOLD THE TRUTH ABOUT ALCOHOL

Another famous doctor was Elias Metchnikoff, a Russian Jew born at Kharkov in 1845. He was awarded the Nobel prize in 1908 for his epoch-making discovery of the functions of the white cells of the blood in protecting us from disease. He also showed clearly that alcohol is one of the greatest enemies of life and health, weakening the powers of resistance Nature has built up within the human body. His later studies were devoted to discovering some means of prolonging human life; but while the venerable scientist was engaged upon these researches he himself died in Paris, in 1916. The secret he was seeking had eluded him.

THE TWO MOSQUITOES THAT STRUCK DOWN MILLIONS OF THE HUMAN RACE

One of the greatest achievements of medical science in our time has been the conquest of tropical diseases through the discovery and mastery of two of the most terrible enemies the human race has ever known. The men who crowned with success the long search for these slayers of men were Sir Ronald Ross, in India, and Dr. Walter Reed, in America.

It was Dr. Ross who found out Anopheles and Dr. Reed who found out Stegomyia. What they found was that Stegomyia carried in its body the author of yellow fever, and that Anopheles carried within it the author of malaria, so that a bite from one of these mosquitoes might at any time bring death. The parasite of Anopheles is known, that of Stegomyia is still unknown. But we know that both these fearful parasites inhabit the bodies of the mosquitoes, which give them to man when they suck his blood. Half their lives the parasites spend in the body of the mosquito and half in the body of man.

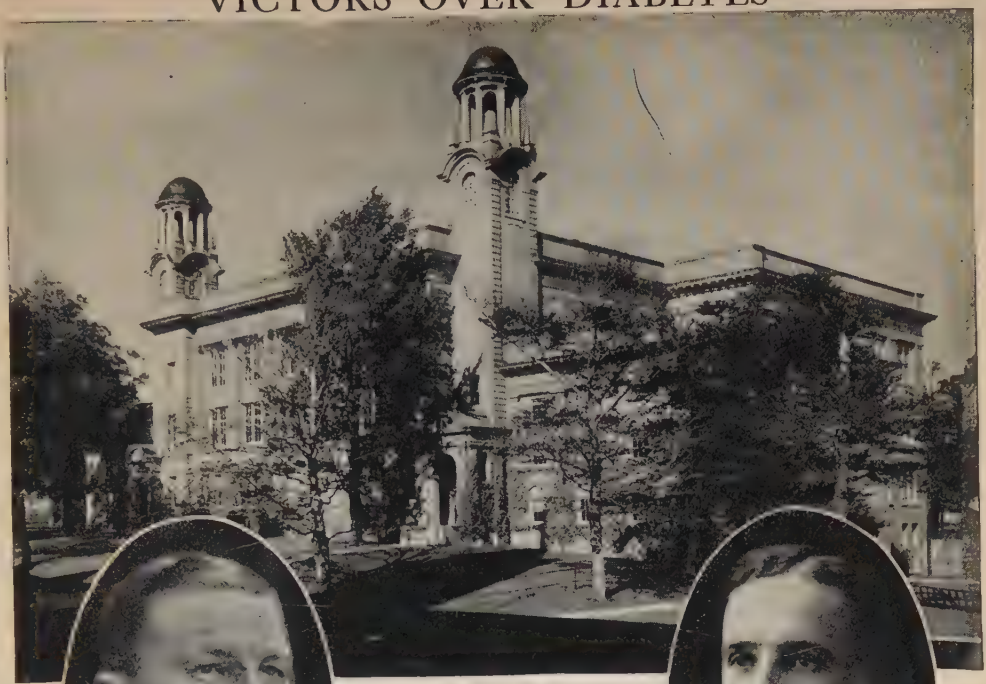
So, for ages past, in the history of the world, two little mosquitoes have carried within their bodies the fearful creatures which have struck down millions of unhappy members of the human race. They have held whole continents back from civilization and have made tropical countries impossible for white races.

These little pools by the wayside, the little pockets of water in the waste places —what a mighty meaning they have had in the history of the world! For in them the mosquitoes breed. These still waters —like the pools of water in which the French doctors set the bedsteads in the hospitals—were the very birthplace of these great afflictions that struck down whole races of men. They attack those rich regions of the earth of greatest value to mankind. They strike down not only the native people who inhabit them, but the carriers of civilization, too—the pioneer, the planter, the trader, the missionary and the soldier.

THE SHIPS THAT ROTTED IN THE HARBOR AND THE CREWS THAT DIED

The pages of history are black with the story of these terrible diseases. Yellow fever followed Columbus to America in 1493, and was so bad here that the king of Spain had to throw open his jails for volunteers. And still, within the lifetime of living men, yellow fever was raging in the same West Indies, so that in a few months 69 in every 100 white troops in Demerara perished. There is a sad story of a general who lost his reason when, in spite of all he could do for his brave men, they were struck down in hundreds by invisible bullets.

VICTORS OVER DIABETES



The birthplace of Insulin.

Dr. Frederick Grant Banting (left) and C. H. Best (right), the two brilliant young Canadians who discovered insulin, which has saved the lives of many sufferers from diabetes. Insulin is manufactured in the building in the lower picture. Both buildings belong to the University of Toronto, Toronto, Canada.

Photos of buildings, University of Toronto, University Extension, Toronto; C. H. Best's photo by Mr. Lyonde, Toronto.

One traveler spoke of it as so terrible that it seemed as if the European carried something in his pocket which, coming in contact with the tropical atmosphere, lighted up a conflagration. In Brazil there were 35,000 deaths in one year, and ships rotted in the harbor because their crews died and none could be found to replace them.

All over the tropical world the mosquitoes came up out of the pools and spread death and misery and disaster among mankind. And *nobody knew.* It is said that there is an old book in the world, written fourteen hundred years ago, which declares that malaria is caused by a mosquito. We know that Dr. Beauperthuy declared that this was so in 1856; but either nobody noticed these things or nobody believed them, and the affliction of the human race went on.

THE MOMENTOUS DISCOVERY OF A TIRED AND DISAPPOINTED MAN

It is good now to come, in the story of this great conquest, to the time when Major Ronald Ross sat looking through his microscope in India at the last two mosquitoes that he had to examine. Working eight hours a day at his microscope, tried by the heat and tortured by flies, his sight grew dim and his body sank with fatigue. But still he went on, gazing intently into the dapple-winged mosquito upon which his microscope was turned. He was profoundly disappointed and was about to abandon his task when, he tells us:

> I saw a very delicate circular cell, apparently lying among the ordinary cells of the organ, and scarcely distinguishable from them. Almost instinctively I felt that here was something new. On looking further, another and another similar object presented itself. I now focused the lens carefully on one of these and found that it contained a few minute granules of some black substance, exactly like the pigment of the parasite of malaria. I counted altogether twelve of these cells in the insect, but was so tired with work, and had been so often disappointed before, that I did not at the moment recognize the value of the observation. After mounting the preparation I went home and slept for nearly an hour. On waking, my first thought was that the problem was solved; and so it was.

If that waking moment was memorable in the life of Dr. Ross, it is memorable, too, in the life of the world, for it was the beginning of the end of Anopheles, the scourger of humanity, the ravager of continents, the repeller of civilization. A new hope had come to the human race.

THE NEW DOOR THAT OPENED INTO THE TEMPLE OF KNOWLEDGE

Here is the thought with which Dr. Ross himself looked out on the world that day. These are his words:

> The exact route of infection of this great disease, which annually slays its millions of human beings and keeps whole continents in darkness, was revealed. These minute spores enter the salivary gland of the mosquito, and pass with its poisonous saliva directly into the blood of man. Never in our dreams had we imagined so wonderful a tale as this.

What it all meant to the world we may see from one instance. Malaria had broken out at Ismailia, in Egypt, and flourished until it was computed that every inhabitant suffered from it, when Major Ross was sent for. In two or three years he stopped the breeding of mosquitoes and changed Ismailia into a health resort.

While Dr. Ross was searching in India and discovering the author of malaria in Anopheles, Dr. Reed and three or four comrades in the United States Army were searching in Cuba for the author of yellow fever. It was almost certain, after Dr. Ross's discovery, that the parasite of yellow fever had its home in a mosquito. How this was proved by Dr. Reed is one of the thrilling stories of the world.

ONE OF THE NOBLEST DEEDS IN THE STORY OF THE WORLD

There is no adventure anywhere more instinct with heroism than the search for the author of yellow fever and its discovery in Stegomyia. Even if there had been no gain for freedom in the Spanish-American War, the conquest of yellow fever would have been worth the war a hundred times. A hundred thousand men died of yellow fever in three years under Spanish rule. In forty-seven years 35,000 people died in the city of Havana alone.

It was into these things that Dr. Reed and his comrades were sent to investigate. One of them died, and the camp was named after him—Camp Lazear. A great name this will be in the real history of the world, if ever its real history is written. One picture that Dr. Reed has left for us shows how the spirit of heroes and the love of humanity hovered about this camp.

Two men were wanted for experiments, and two young privates in the army came forward and offered themselves. They were to be bitten by suspected mosquitoes. Major Reed talked the matter over with them, explained the danger and suffering, and then, seeing that they were still determined, promised that they should be generously compensated for their sacrifice. It must have thrilled Dr. Reed to find that the moment he mentioned money these plain American men held back. Both declined to undergo the experiment except on the sole condition that they should have no money reward. Major Reed touched his hat to the privates and said: "Gentlemen, I salute you"; and he said afterward that in his opinion this exhibition of moral courage had never been surpassed in the United States Army.

That is how it was discovered that Stegomyia carries yellow fever and gives it to man with its bite. It is sad to have to say that Dr. Walter Reed gave this discovery to the world as almost his last service to it; for he died soon after, having earned for himself the gratitude of all men living and all men to be born.

No event in history, it may perhaps be said, has had more sweeping results or brought more blessing to the human race than this conquest of tropical diseases. One of the results was that yellow fever was practically abolished in Cuba, and in Panama the stamping-out of the disease made it possible to dig the Panama Canal. This stupendous achievement, unique in the history of engineering, could never have been possible had not the doctors conquered those tropical diseases. The credit for the canal is due first to the doctors and discoverers we have mentioned, and then to Surgeon-General Gorgas, who carried out the work and made Panama, one of the foulest death-traps on the earth, into a health resort.

DR. NOGUCHI DISCOVERS PARASITE OF STEGOMYIA

A new era of combating yellow fever, by destruction of mosquitoes, was opened up in 1900 by the discovery of the American Army Board, under Major Walter Reed, of the mode of spreading the disease by the domestic mosquito then known as *Stegomyia fasciata.* (The name of this mosquito has been changed by expert entomologists to *Ædes ægypti.*) The Army Board did not, however, find the parasite which the mosquito carried, nor did numerous later investigators find it, one reason being that the microbe of yellow fever is not visible by the ordinary microscope except when killed and properly stained by certain dyes.

Dr. Noguchi, who was a member of the Yellow Fever Commission sent by the International Health Board of the Rockefeller Foundation in 1918 to Guayaquil, Ecuador, finally found, by means of the darkfield, or "ultra-microscope," a very small spiral germ in the blood of a person sick with yellow fever. Under the darkfield microscope the living, active parasites are illuminated in a special way by a powerful light and appear as bright objects on a dark background. Dr. Noguchi injected the blood into young guinea pigs. Within a few days they became feverish, and later they showed the various symptoms by which we recognize yellow fever, of which the best-known is the yellowness of the skin of the whole body.

Dr. Hideyo Noguchi.

He found the same parasite in the blood and organs of animals which developed yellow fever after the injection

of blood of yellow-fever patients, and also in the mosquitoes which had sucked the blood of yellow-fever patients. He succeeded in making the parasites grow and multiply in the culture tube by furnishing them with the proper food, and with these artificially grown germs he again produced yellow fever in guinea-pigs. Finally, he prepared from the cultures a vaccine which prevents human beings from contracting yellow fever and a curative serum which saves those who have already developed the disease.

The discovery of the parasite of yellow fever has furnished us with a means of supplementing the mosquito campaigns, and we can now protect human beings against yellow fever by means of the vaccine prepared with killed cultures of the parasites. Furthermore, no cure for yellow fever was previously known, and one who had the disease had only a "fifty-fifty" chance of recovery, that is, one out of two cases usually died. The curative serum which Dr. Noguchi has prepared, however, if given within the first three days of illness, kills off the germs in the body and prevents them from invading and destroying the vital organs; hence the chance of death from yellow fever has been reduced to the minimum.

A BENEFACTOR OF THE WORLD AND HIS THREE GREAT VICTORIES

Sir David Bruce, of the Army Medical Staff of Great Britain, who was born in Australia in 1855, must be classed with Sir Ronald Ross and Dr. Reed as a great benefactor of humanity, for to him medical science owes three great victories. When serving in Malta he investigated the obscure disease known as Malta fever which was prevalent there and around the shores of the Mediterranean. Tracing it to goats, he was able to identify the germ in their blood and milk. Later, too, he was able to make a vaccine which was useful in the treatment of the disease. In 1895 Sir David Bruce went to South Africa, and there he won his second victory by discovering that tsetse-fly disease was due to a germ carried and injected by the tsetse fly. His third great victory was his discovery that the germ of sleeping-sickness was also carried and propagated by a species of the tsetse fly.

Here must be mentioned also two German doctors whose researches have resulted in great discoveries. Dr. A. E. Behring discovered the treatment of diphtheria and tetanus by means of antitoxins, and the diphtheria antitoxin alone has saved the lives of hundreds of thousands of children. Dr. Paul Ehrlich discovered the remedy known as salvarsan, which has also been triumphant in conquering a deadly disease.

THE DOCTORS WHO MAPPED OUT THE MOVEMENTS OF THE BRAIN

Two great brain surgeons of our time should be briefly mentioned here. Sir David Ferrier, born in Aberdeen in 1843, investigated the motor areas of the brain and succeeded in identifying the centres of various movements. Sir Victor Horsley, the famous surgeon, born in London in 1857, extended Ferrier's work and performed many marvelous and successful operations on the brain. He was a valiant and fearless fighter for good causes, and an unwearying investigator. He was one of the saddest human losses of the World War, for he gave his services to the British army and died on duty in the fierce heat of Mesopotamia.

THE MAN WHO THOUGHT OF USING RAYS OF LIGHT TO FIGHT DISEASE

Niel Finsen, though also not a practicing doctor, must be put among the famous doctors of modern times. He was born in the Faroe Isles in 1861, and at the age of thirty-two he began to experiment on the effects of light on the human body.

Finsen confirmed the old belief that red light was useful in the treatment of smallpox. Blue and violet rays of light, on the other hand, had a stimulating effect on the skin. Dr. Finsen found that the fearful disease of lupus, or consumption of the skin, could be arrested by exposing the skin to these rays.

Dr. Finsen, whose Finsen lamp is known throughout the medical world, died in 1904, but his name lives after him, among those noble names of men whose lives have been a blessing to mankind.

DR. ALEXIS CARREL, THE GREAT FRENCH SCIENTIST, JOINS ARTERIES

One of the best-known scientists of our time is Dr. Alexis Carrel, a Frenchman, who was born near the city of Lyons, in the south of France, where his father was a silk-manufacturer. His school and college days were spent at home, and he graduated from the University of Lyons, where he took his degree in medicine in 1900. Five years later he became a member of the staff of the Rockefeller In-

stitute, and much of his work has been done at that great institution.

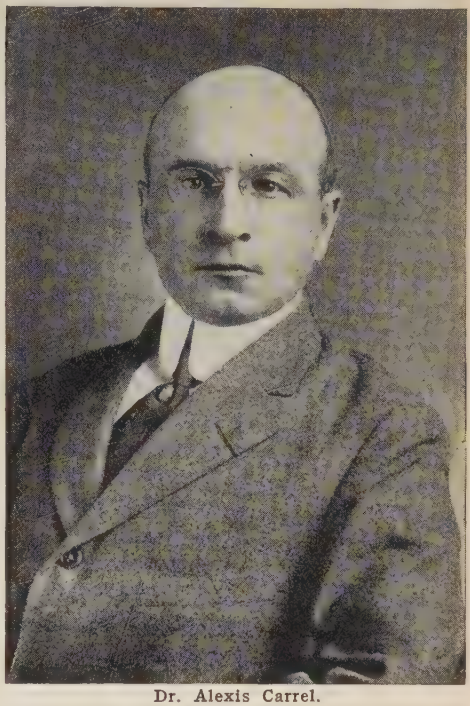
It is difficult to tell of the work of this one man, it is so amazingly wonderful. Before his time the flow of blood from an artery that had been cut could be stopped, but ever afterward the artery would be useless. Dr. Carrel found out a way in which the artery could be joined so that it would be able to carry on its functions as before. He discovered that as long as it can be kept alive, the stuff of which our bodies are built can be made to grow, just as microbes can be made to grow, and this makes it possible to take a vein from a part of the body where it has not much work to do and put it in the place of an important vein that has been destroyed, to transplant bones from one part of the body to the other, and to perform many other wonders in surgery that have been done for men wounded in the World War.

Now Dr. Henry Drysdale Dakin, who is not a doctor of medicine but a doctor in chemistry and biology, had discovered that a solution of hypochlorite of soda will kill the microbes, or bacilli, as they are more often called, no matter how many there are in a wound. Dr. Carrel learned of this treatment from Dr. Dakin, who was working with him among the wounded, and at once began to apply it. To make it successful, however, it is necessary to keep the wound always moist with the solution and keep the solution away from the healthy skin, which it would injure. So Dr. Carrel made a clever arrangement of tubes which run down from the jar of solution above the patient's head, and every two hours a nurse goes round the ward and lets the solution run down these tubes into the wound. When all the bacilli have been killed the wound heals up and the patient quickly recovers.

THE MEN WHO WERE VICTORS OVER DIABETES

A discovery made since the World War by two young Canadians marks another step forward in the conquering of disease. Dr. Frederick G. Banting, assisted by C. H. Best, M.A., discovered a means of fighting diabetes successfully. When certain parts of the pancreas cease to do their work, the sugar in the blood is not properly employed and the patient becomes the victim of a form of diabetes. Dr. Banting found out what could overcome this accumulation of sugar. By injecting a substance, "insulin," diabetes is held in check. By the proper use of Dr. Banting's discovery and by attention to diet, the diabetic person can maintain life and health for many years.

Frederick Grant Banting was born in 1891 in Alliston, Ontario, and educated in Victoria College, University of Toronto. He graduated from the Faculty of Medicine of the university in 1916, and during the World War served for four years with the Army Medical Corps of the Canadian



Dr. Alexis Carrel.

Expeditionary Force. He was wounded at Cambrai in 1918, and later received the Military Cross.

When the war ended he practiced privately, and also acted as assistant in the department of physiology in the University of Western Ontario. In 1921 he returned to Toronto and began the researches which led to the discovery of insulin. For this discovery he and Prof. J. J. R. Macleod jointly received the Nobel Prize in medicine in 1923 and many other medals and prizes. He became the first holder of the Banting and Best Chair of Medical Research, established by the province of Ontario in the University of Toronto.

THE NEXT STORY OF MEN AND WOMEN IS ON PAGE 5639.

LIFE AMONG THE PEOPLE OF FLANDERS

A Flemish milk-girl.

A peasant lace-maker.

Delivering the milk in a village of Flanders.

The colossal Palace of Justice at Brussels.

BELGIUM AND HER PEOPLE

THE small country of Belgium —its area is 11,752 square miles—has always filled a very important place in European politics, trade and industry; and there are two reasons for this. The first reason is that it lies at the crossroads of Western Europe, on the direct route between London and Berlin, and between Berlin and Paris. The second reason is that the country has immense natural resources, and its people an untiring industry and perseverance.

Although Belgium is a small country, its surface is very varied, and its inhabitants belong to two distinct races. The old Roman road which ran from Cologne, through Maestricht, Tongres and Cambrai, to Boulogne, follows at a short distance the course of the Meuse and the Sambre. To-day the main line of railway follows very much the same course. By that route invading armies have marched into and across Belgium for centuries, and by that route the Germans advanced in 1914. This line is marked by a string of fortresses and by the battlefields of centuries, including the most famous of them, the field of Waterloo, which lies to the north near Brussels.

In the old Roman days the Silva Carbonaria, the great forest of the Ardennes, came right to the edge of the road, and a great part of the high land southeast of this line is still forest. In the wooded hills the Celts found refuge from Saxon and German invaders, and the Roman road which bounded the forest forms the language line of Belgium to-day, the line between the French-speaking Walloon population and the Flemish-speaking Teutonic races. If you draw on your map (page 5557) a line perfectly straight from Tongres to Courtrai, you have the northern limit of French as the language of the common people. The two races are very much mixed, and French pushes its way north of this line. Educated people speak it everywhere; Brussels is chiefly French, but the common tongue in the countryside is Flemish.

Belgium is the most thickly populated state in Europe. It has a population of between seven and eight million people, which means that on an average there are 636 persons to a square mile. This dense population is not gathered together in large towns as it is in England; even Brussels has not as many inhabitants as Birmingham. In the Flemish districts great numbers of people live outside the towns in houses with gardens or plots of land, the produce of which helps to eke out their wages. The Flemish worker is more apt to crowd into the

towns than his Walloon brother. In the whole of Walloon Belgium there is only one place, Liége, which has more than 50,000 people, but the countryside is thickly dotted with industrial villages and with tiny homesteads. Rail and car services are so good and cheap, especially the workmen's fares for longish distances, that men can afford to live some miles away from their daily work.

A QUAINT TALE OF A HORSE OF THE ROMANTIC ARDENNES COUNTRY

The hill country of the Ardennes is a continuation of the highlands of western Germany and Luxemburg. It is really a plateau, in the hills of which deep gorges have been cut by the Meuse and the Sambre and their tributaries. This is the delightful and romantic country where the Four Sons of Aymon hid from the vengeance of Charlemagne. Near Dinant they still show the traveler the Roche Bayard, where the famous steed of Renaud, or Rinaldo, detached the great mass of rock from the mountain with a kick of its mighty hoof; and once a year, on the eve of St. John, the peasants say that Bayard can be heard whinnying in the forest. Dinant is one of the places which suffered most heavily in the German invasion. The limestone which is to be found thereabouts has been worn by the action of rushing streams into a thousand strange shapes. Steep cliffs overhang the streams, and at Han is the famous labyrinth of grottoes through one series of which runs the river Lesse. In the neighborhood of Dinant are great limestone cliffs, and many curious limestone caves with stalactites hanging from the roof.

THE GREAT AREA IN WHICH COAL AND IRON ARE FOUND

To the north of the Meuse and the Sambre, in a line stretching for 115 miles from Liége to Namur, Charleroi, Mons and St. Ghislain, are the Belgian coalfields, with iron-mines on each side of the rivers between Huy and Charleroi. The land of the Belgian black country lies about 150 to 600 feet above sea-level, and slopes gradually to the northwest, being drained by a number of rivers which run into the Scheldt. The rich soil of the plains of central Belgium is excellently suited for agriculture. Every inch of it is cultivated. The Belgian farmer generally owns his small-holding, and he and his family work very hard, in many cases producing two crops every year. The fertile belt stretches west into Flanders, and yields, under patient tillage, heavy crops of wheat, rye, sugar, beet, chicory, potatoes and all sorts of vegetables, grown for export to France and England, as well as for the home market in Belgium. In the sheltered valleys of the Meuse the vine is grown.

The whole of Flanders is densely cultivated. Its two principal rivers are the Lys, famous for the retting (the separating of wood from fibre by soaking) of flax, and the Scheldt, on which the great medieval free cities of Ghent and Antwerp grew up. To the northwest of the Lys lie the low hills made famous in the World War, running in a line from Hazebrouck to Ypres. But the most curious district of Flanders is the strip of low-lying country, from five to ten miles broad, running along the coast from Dunkirk on the other side of the French frontier to Antwerp.

HOW THE LOW-LYING LAND IS PROTECTED FROM THE SEA

This land is protected from the sea by a system of dunes a mile or more deep, and is drained by canals filled with fresh water. Between the canals lie the rich pastures known as polders. Near the French frontier the polders have to be kept dry by pumping. These districts can be put under water, and were in fact flooded during the war by way of defense.

There are no natural harbors, but the mouths of the Yser at Nieuport, and of the canals at Ostend and Zeebrugge, have been made available for ships. All along the dunes watering-places with casinos and promenades have sprung up—thin lines of villas and hotels now almost continuous—for people who want the sea-bathing. Ostend is one of the gayest watering-places in Europe.

On the inner edge of this strip lies Bruges, at the junction of canals leading to the sea. Bruges has been left deserted for centuries, but, with the new developments at Zeebrugge, may yet see a great revival of trade. This low-lying country is the first glimpse the traveler sailing up to Antwerp has of Belgium. Grass of a dazzling green, bordered here and there by a slip of shining sand between it and the water's edge, and tiny houses of a red brick as brilliant in tone as the grass; and, presently, the great cathedral tower and tall warehouses of Antwerp—just the

GIRL WORKERS OF THE SEA AND THE MINE

Shrimpers setting out to work near Ostend.

An industrious family outside their cottage home in Flanders.

A girl hauling a truck at a coal-mine in Charleroi.

same bright-colored land-and-water landscape as is characteristic of the Dutch coast. Large districts of Flanders have a very sandy soil. The long straight roads are lined with trees, and the ditches with hedges which help to bind the sandy soil.

THE GREAT WEALTH NOW BEING WON FROM AN OLD TRACT OF BARREN LAND

Away to the northeast, north of a line drawn from Malines to Maestricht, is a continuation of the coastal plain, a huge tract of barren sandy country, which even Belgian industry has failed to make fertile. This is the Campine, or Kempenland, which stretches across the Dutch and German borders. Until not so long ago this was regarded as waste land fit for nothing but fir and larch. But it holds that most precious of gifts to an industrialized country, the "black diamonds" of coal. The coal is close to the surface, and makes good coking coal for the iron industry. Here also is iron, though it is not yet worked.

The Belgian ironworks had formerly to buy coking coal from Germany; now they find they have seams which yield heavier returns than those of the old workings of the Meuse-Sambre coal-field. The development of the coal industry is changing the face of this desolate, barren country, and busy industrial centres are growing up like mushrooms. The sand, too, is excellent for glass, and all sorts of raw materials pour in through the port of Antwerp, which is close to the new field. New railway lines are being built, and it is proposed to build a new canal. In 1917 the Campine produced 11,640 tons of coal; in the first ten months of 1923 it produced 653,000 tons. This shows at what an enormous rate the yield is growing.

WHY LITTLE LUXEMBURG WORKS HAND IN HAND WITH BELGIUM

The Treaty of Versailles after the World War gave Belgium two small districts formerly under German rule, Eupen and Malmédy. The hilly country of Luxemburg, with its valuable iron-mines, was and is an independent state, but before the war it formed part of the German Customs Union. After the war the Luxemburgers did not want to be in the German Union, so they voted to decide on the future. The voting was for a customs union with France, but France declined, and as a second choice the people turned to Belgium. So there is now no customs frontier between Belgium and Luxemburg, and Belgian money and Belgian postage stamps are used in the duchy. This is very important for the steel industry, as most of the iron used for steel-making in Belgium comes from Luxemburg.

Hardly any country in Europe has made so quick and good a recovery from the war as Belgium, chiefly because the Belgians work very hard, and partly because the Germans, in making the most of Belgian resources during the war, showed the way to new developments. The excellent port of Antwerp has been developed and improved; Ghent, with a deep ship-canal northward to Terneuzen in Holland and other canals westward to Bruges, Zeebrugge and Ostend, is a busy port; and many ships sail direct from London to Brussels up the Scheldt beyond Antwerp and then by canal. Ostend is extending her harbor. If we look at the map we see that Antwerp, the great port which is a rival to Rotterdam and Hamburg, is in a very strange position. For the south side of the broad estuary is Dutch, as well as the islands. A small piece of what looks as if it must be Belgian mainland has remained Dutch.

THE NEW PORT WHICH IS TAKING THE PLACE OF ANTWERP

It was because Holland held the entrance to the Scheldt that Antwerp was prevented from becoming a great port until the last century. The Dutch did not want to allow so near a rival to Rotterdam. The navigation of the Scheldt is under a joint commission, and is closed in time of war. But the Belgians are very conscious that the approach to their great river and their principal port is commanded by another nation. That is one of the reasons for the enormous development of the new artificial port of Zeebrugge which is being made into a first-class harbor, not without some opposition from reviving Bruges, which thinks its interests are threatened. There is now a train-ferry service between Harwich and Zeebrugge, so that fragile goods can be shipped between England and Belgium without the cost and risk of lading and unlading at the ports.

Although the Dutch and the Belgians have lived side by side for centuries, they have not been good friends. The Dutch

The Quai aux Herbes at Ghent.

The Broel Bridge at Courtrai.

The Town Hall of Oudenarde.

are, on the whole, rich and well educated. They are Protestants, and are of pure Teutonic race. They are a serious people. The Belgians, as we have seen, are crowded together. Until recently their public educational system was left almost entirely to the individual commune. They are a mixed race; they profess the Catholic faith; and they have a keen, broad humor. So the two peoples, though at times they have been under one government, are very different. Since the World War, as her defense against invasion has ceased to be guaranteed by the great powers, Belgium is free to do as she pleases, and make alliances with her neighbors. But she has a hard history, which has left a lasting mark on the country and the people.

THE ELECTRIC POWER THAT WILL HELP THE INDUSTRIES OF BELGIUM

Evidence of her enterprise is seen in the arrangements for concentrating the generation of electric power in giant stations, and for transmitting the current over long distances. The new industrial area growing up in the Campine will have complete electrical facilities, and, as good, cheap electric power lessens the cost of production enormously, the industries now being established there will be able to compete easily with those of Germany and England. At the same time Belgium is developing her communications with her neighbors by air. The Brussels aerodrome is a halting-place for air traffic between London and Cologne and between Amsterdam and Paris. Both Brussels and Antwerp have direct telephone service with London.

The most important Belgian heavy industries, the making of steel, mechanical construction (bridges, girders, steel frames for building, pumps, cranes, motors, engines, boilers, rail and car-line material) are naturally grouped on the coal-field, the chief centres being Liége and Charleroi, though there are also important works at Brussels, Ghent and Antwerp.

THE CHIEF PRODUCTS OF BELGIUM AND WHERE THEY ARE MADE

The making of sheet and plate glass, in which Belgium excels, is also mainly carried on on the coal-field. Zinc, with its by-product sulphuric acid, one of the most valuable of Belgium's natural resources, is found between Liége and Aix-la-Chapelle, partly in the neutral territory of Moresnet, and is treated on the Sambre-Meuse coal-field and in the Campine. Pottery, paper and works for the production of industrial chemicals are scattered all over the country; cotton and linen mills are found at Ghent and elsewhere in east Flanders; woolen-cloth factories in and around Verviers, Antwerp and other places; tapestries and fabrics of mixed cotton, silk and wool are made around Courtrai; carpets at Brussels and elsewhere; and lastly there is the diamond industry of Antwerp, a trade which that city shares with Amsterdam. Generally speaking, wages are low and the workmen poor, but conditions improved after the World War. One of the things they are trying to do in Belgium is to give workingmen an addition to wages according to the number of children in the family.

In spite of all this development and in spite of the storms of war and revolution which have swept over her repeatedly in the last two hundred years, Belgium is, perhaps, the best country in Europe in which to study the medieval civic life and organization of Northern Europe. The monuments and the art of the prosperous centuries before Spain broke the Low Countries are still preserved.

THE ANCIENT CITY MEN USED TO CALL THE VENICE OF THE NORTH

Bruges is a fine example of the industrial city of those days. Before there was thought of pulling them down to make room for modern factory and workshop, the houses and buildings of mellow red brick in her ancient streets and along the quiet canals made men call her the "Venice of the North."

In the thirteenth and fourteenth centuries, when the communes were freeing themselves from the feudal lords and building up the industry and trade which were to make the Flemish cities a marvel to later travelers, the townspeople built the market hall with its belfry, often containing the marvelous carillon in which Belgian metal-workers excelled. This hall was nearly always strongly built and capable of defense. The tall belfry which ornaments so many Flemish cities, sometimes built as part of the Halles, or markets, sometimes, as at Ghent and Tournai, a separate building, was a sign of the independence of the citizens; from the belfry the bell called the burghers to work and prayer, and the tocsin called them to arms to defend their liberties in case of need. Here and there,

as at Ghent, the rival building, the fortified castle, still exists. There are many magnificent examples of this civic architecture in Belgium—the Cloth Hall of Ypres, with its beautiful long lines and high-pitched roof, now, alas, destroyed by shot and shell; the Halles and Belfry of Bruges, of Ghent and of many another less famous town. The oldest of these belfries is at Tournai, for the building of which a charter was obtained from Philip Augustus of France in 1187. These are typical of old Belgium.

THE RIVER MEUSE AS IT PASSES THE FORTRESS OF NAMUR

Later, in the fifteenth and sixteenth centuries, when these same towns built their town halls, the architecture became highly ornate and decorative. The idea governing their extravagant style was to display the splendor and riches of the town and its artistic genius; there was no longer any need of defense. Perhaps the most magnificent of the many fine town halls in Belgium is the Hôtel de Ville on the Grande Place in Brussels.

The Grande Place is a wonderful square. Opposite the highly decorative Hôtel de Ville is the splendid Gothic Maison du Roi, or Bread House, and on the other sides stand the old houses of the merchant guilds, with their high pointed gables, their balconies and their quaint sculptures. The town hall of Louvain, which luckily escaped when the library was destroyed in August, 1914, is a highly decorated example of Belgian civic art, but it has been much restored. Nowhere in Europe has civic architecture been more magnificent than in the Flemish cities. A nation of merchants, craftsmen and manufacturers, subject for centuries to foreign rule, they found freedom and self-government in the city, and nothing was too good to express its greatness.

The old Belgians were also a deeply religious people. They looked up to the saints as the founders of their loved cities. Had not St. Amand founded Ghent when he pitched his monastery at the junction of the Scheldt and the

Lys? Their art and their industry they owed in many cases to the monks. Most of the churches built in the days of Charlemagne and the following centuries in the Romanesque manner have perished, but parts of the Church of St. Guy, at Anderlecht, of the minster Church of Nivelles, of some of the churches at Bruges and of that of St. Servatius at Maestricht, go back to this period.

But most of the great churches are built in the Belgian Gothic style; this was introduced in the cathedral at Tournai in the twelfth century by French architects, but the builders of great Belgian churches adapted it and made it national. The octagonal towers, the rounded turrets, and the width and spaciousness of the interiors give them their peculiar beauty.

THE NOBLE GOTHIC CHURCHES BUILT BY THE ARCHITECTS OF BRABANT

The architects of Brabant were famous all over Europe. The Cathedral of St. Rambaut at Mechlin, with its mighty square tower; of St. Bavon at Ghent; the Church of Notre Dame du Sablon at Brussels, built for the Guild of Crossbowmen; the great Church of St. Gudule at Brussels, with its two towers; and Antwerp cathedral, of whose western towers only one was finished, to serve as a beacon to mariners on the Scheldt—these are only some of the wonderful Belgian Gothic churches.

Originally these churches were brilliant with color, with mural paintings and with gold. Every kind of craftsmanship was lavished on them, in sculpture, in stone and wood, in brass, copper and iron work, in tapestry, in stained glass, and in painting. Much of this treasure was destroyed by the Calvinists in the sixteenth century, and the churches again suffered in the Revolution in 1793, but much remains. The painters of each town in the fourteenth century formed themselves into a guild, like other tradesmen, but they did not confine themselves to easel work; many of them practiced other crafts as well. Like the Greeks, the Belgians preferred their statues colored. Jan van Eyck himself colored some of them.

BEAUTIFUL RELIGIOUS PAINTINGS ABOUND IN THE CITIES OF FLANDERS

The Flemish cities, too, are rich in paintings of the great Flemish religious school. We may see great pictures by Roger van der Weyden, the brothers Van Eyck, Quentin Matsys and the rest in galleries, but it is better to see them in the churches for which they were originally designed. In the old Hospital of St. John, at Bruges, are the best works of Hans Memling. In the Cathedral of St. Bavon, at Ghent, is Hubert and Jan van Eyck's Adoration of the Lamb, two panels of which found their way to Berlin but have been restored. To Jan van Eyck is generally ascribed the discovery of the art of painting in oil; in any case the colors of this great series of pictures are still fresh after five hundred years. Antwerp cathedral counts among its treasures Rubens' Elevation of the Cross and Descent from the Cross, and on the High Altar is the same painter's Assumption. Rubens painted many pictures for the Jesuit churches, some of them gay and full of the pleasure of life and far from devout, but the Jesuits did not hesitate to press secular art into the service of religion.

One other kind of architecture is peculiar to Belgium, that of the tranquil squares and gardens surrounded by low houses and adorned by a church. In the fourteenth century were devout men and women who took no religious vows, but found refuge from the world in these quiet places, working for their living with their hands and giving their leisure to prayer. Some of these communities remain; they were for aristocrats, but most of them are now for simple working people.

THE GLORIES OF THE MIDDLE AGES CHERISHED BY THE BELGIANS

These places have provided many poor men and women with a quiet home. Many were destroyed at the Revolution, and many have now been secularized. At Louvain is one of the most charming of these Old World places; there is one at Bruges, on the bank of the Roya, and in Ghent there are two, so large as to be almost little villages by themselves.

What will be the future of Belgium? She is a highly modern industrial state, but the monuments of the pious craftsmen of the Middle Ages continue to be cherished as her greatest glory, by the Belgians themselves and by those of us who turn back in imagination to the guildsmen — riotous and hard-working, but every one of them alive to beauty and striving to embody it in art.

THE NEXT STORY OF ALL COUNTRIES IS ON PAGE 5555.

The House of the Franc at Bruges.

The Town Hall of Louvain.

A quiet corner of Bruges.

QUAINT SPOTS IN OLD BELGIUM

Rue St. Martin, Tournai.

Steps to the Citadel, Liége.

Tower, Malines Cathedral.

The picturesque little town of Rochefort.

Boats in the harbor at Ostend.

THE BEAUTIES OF ANTWERP AND BRUSSELS

Congress Column, Brussels.

Church of St. Gudule, Brussels.

Town Hall, Brussels.

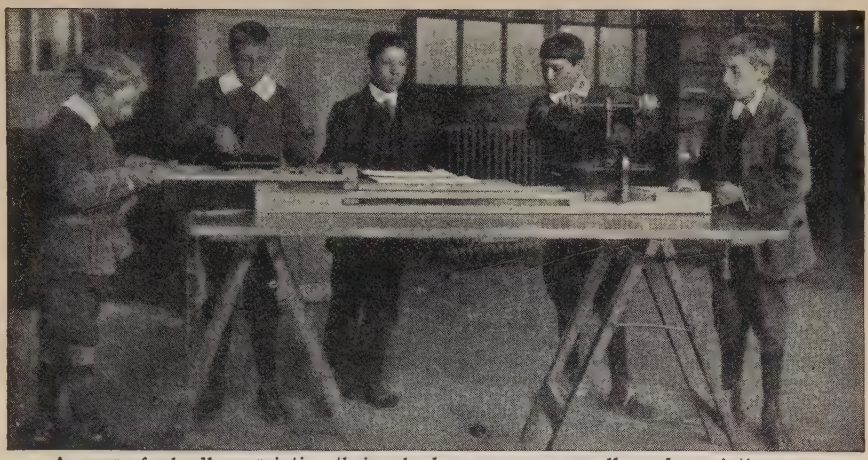
The beautiful Grande Place in the Belgian capital.

Antwerp, the second city of Belgium, seen from across the Scheldt.

The Town Hall at Bruges.

The Belfry of Bruges.

A fine group of towers in Ghent.



A group of schoolboys printing their school paper upon a small wooden printing-press.

STARTING A SCHOOL PAPER

A SCHOOL paper cannot well be undertaken by one person alone. There are so many different things to be done, and so many of them call for special aptitude, that the work is best accomplished by a division of labor.

Whoever is going to run a school paper must take care to select helpers in such a way as to insure all branches of the work being really well done.

The work can roughly be divided into four main parts, which may be called the writing, the drawing, the printing and the selling. A school paper may be founded by four friends, each of whom will undertake the charge of one of the above departments.

Much of the success of the venture depends upon the firmness of the friendship which exists between the founders. Nothing demands more unity of action than the production of a school paper.

Let us consider these four friends and see what qualities fit them for the posts they will occupy. The editor is of necessity the chief; he must be a good scholar—so good that none of his schoolboy critics will be able to pull him to pieces. He must also be on fairly good terms, not only with his schoolfellows, but also with his teachers. These latter will be of the greatest assistance to him, not only in furnishing occasional articles, but also in influencing the circulation. One of the teachers of a literary turn of mind might be persuaded to look over the manuscript articles submitted, and correct the grammatical blunders which might otherwise be passed over by the youthful editor and so get into print.

The second position, that of art editor, is nowadays an easy post to fill. Most schools of any size possess a fair share of pupils who can draw well, and from among their number a suitable editor can be chosen.

The third position will be that of foreman printer, and whoever fills this post will generally have the whole of his business to learn. Much of the hard work will fall to his share, so that great care must be taken to choose as printer one who possesses a full share of diligence and who is really fond of working with his hands.

The fourth editor will be head of the distributing department and must, above all things, be a genial fellow—one who is on good terms with everyone. He will have to help with the printing, so that he must also be willing to work when needed.

The first question that the founders of the school paper will have to decide will be the method of printing. Printing with type may be impossible because of the expense. If so, some form of duplicator must be bought or borrowed. Should there be such a thing as a school mimeograph, the principal may be prevailed upon to allow its use. Failing this, a hectograph will be found a cheap and easy means of reproduction, and will, if rapidly manipulated, give eighty to one hundred clear copies from one original writing or drawing. The hectograph composition can be bought in cans, and when melted may be poured into any shallow tray.

The question of printing being thus settled, arrangements must be made for obtaining paper. Foolscap or other papers used for educational purposes will be found too expensive, and the local newspaper or

The printing staff of a school paper producing the monthly issue of 350 copies upon a mimeograph.

printing office may be willing to sell the small quantity needed. The size of the school paper must be governed by the size of paper you can buy and by the size of your hectograph. Sheets measuring about 12 inches by 9 inches will be found both economical and handy, and when folded in two will give a page of 6 inches by 9 inches.

The subject-matter will vary with the taste and capabilities of the staff, but certain regular features will probably be common to many school papers. Allusion has been made to the desirability of co-operating with the principal, and this can best be accomplished by offering a page or two of space for school notes. Few schoolmasters will refuse such an opportunity of awakening outside interest in school doings.

After school notes the most important feature will probably be school sports. These can be supplied by the various captains or secretaries, and in schools where directors take charge of sports a timely article on training, fielding, diving, and so on, will be found of general interest.

Here will be ample opportunity for the art editor to introduce a few sketches. Tiny illustrations in the margins take but little time, and help to make the pages look bright. Nature notes of the month and local history are sure to be subjects which are not only full of interest, but are easily written up, either by enthusiasts or by the editor with the help of a few books from the nearest library. Playground gossip will give opportunity for some harmless fun, but the editor must be careful that the fun does not degenerate into unkindness. He must remember that while we should all be able to stand a joke, it is cruel to continually hold anyone up to ridicule.

Now for a word as to printing. At first it will be as well to write the matter in the form of a book, so that the difficulty of arranging pages is approached gradually. After a time the editor and printer will get to know just what the page will hold, and no difficulty will be experienced. Sketches will be more effective if printed in ink of another color, and, fortunately, hectograph ink is made in several colors.

The future of the paper will depend entirely upon its circulation. The price should be fixed so as to be easily within the spending powers of every schoolfellow, and the distributor must endeavor to secure every boy in the school as a subscriber.

Should the circulation outgrow the dupli-

Here we see the boys coloring the pictures in an issue of their paper that is printed ready for publication.

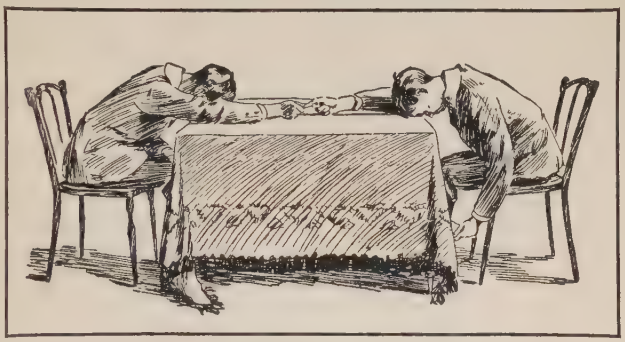
cating powers of a hectograph, the profits will easily purchase a second-hand mimeograph. The price for such a machine will not be great, and there is no limit to its duplicating power if it is skillfully handled.

Additional helpers may, as need arises, be drafted into the scheme, but the editors must take care to enlist only enthusiasts. Apart from the pleasure which the "power of the press" gives, the founders will find their newspaper experiences unconsciously affording them an elementary business training which will be of value to them in after life. The photograph on page 5507 shows schoolboys engaged in printing a monthly issue of 350 copies. In this case the illustrations are colored by hand, and the business side includes such officials as timekeepers, storekeepers, clerks, and so on.

Such an organization is, of course, a matter of time, and we may be sure that our paper, if started in the right way and with the necessary enthusiasm, will grow into quite a prosperous and up-to-date journal. It is splendid experience for all connected with it.

THE WIZARD OF WABASHA

THE trick known as the Wizard of Wabasha is of the mind-reading or thought-reading variety. If cleverly done, it is really wonderful and very puzzling. You tell the audience that even their thoughts are not hidden from you, and you invite one of them—the most incredulous for preference—to come forward and let you prove that it is so. You give him a piece of paper and ask him to write upon it any three questions he likes, and after he has done this you request him to double the paper lengthwise, then to fold it again lengthwise, and then to double it across its length. It will then be a small folded slip. You ask him to hold one end of the folded slip firmly between his forefinger and thumb and you take hold of the other end firmly between your forefinger and thumb. You lead your friend to a table and ask him to sit down on one side of it while you sit down on the opposite side. You have both been holding the folded paper firmly—one each end of it. Upon the table you have already placed a ribbon or leather belt or even a piece of string. Any one of these things will do, as they serve no real purpose but only make an excuse for you to get your companion to do what follows. You explain to him and to the audience that you have the marvelous power of reading his thoughts when you both put your foreheads on the table right on the ribbon or belt or string. Then, if he will think intently upon the questions, you will find out what these questions are and you will answer them.



The Wizard of Wabasha answering the hidden questions.

When both of you have placed your heads upon the communicating band you assume the appearance of deep thought and, if possible, of mental anguish, and finally tell him one by one what his questions are and invent some answers for them. Then, when you have answered his three questions, you release the paper and ask him to open it and show it to the audience as proof that you read correctly the questions he had written.

Now for the explanation of how the trick is done. You have two pieces of paper, one folded exactly as you are going to tell him to fold his, and the other unfolded. You give him the unfolded one, and when he has written it and folded it exactly as instructed you take hold of one end of it. But, hidden away in the palm of the hand that holds his paper, you have the other paper folded in exactly the same way. As you lead him to the table you contrive to make him lose hold of the paper for a second, and when he grasps it again you put between his finger and thumb, not the same piece of paper, but the other or blank piece. Upon this movement depends the success of the trick. Boldness and a ready flow of talk will help you very much by diverting attention, and no one, least of all the writer of the questions, will imagine that the paper now held is not the one containing the questions. That is the secret.

Having succeeded thus far, it is not difficult to put your other hand—your left one—up to your right, and, unseen by the audience, to take the paper with the questions. Then you sit down at the table, and as you have arranged that both of you place your foreheads on the table in order that the thought-reading may be successful, you have the opportunity to read the questions on his paper, which you open with your left hand. The picture shows a young conjurer at this stage of the trick.

After you have read the questions, you have to replace the right paper again. This is rather more difficult than the former exchange was, because you have not the movement of walking to the table and sitting down to cover your actions. Still, you can manage it. As his forehead is on the table, he cannot see your left hand move up to your right to place the paper in it, and as your left hand is the one farthest from the audience, your right arm will help to conceal the movement. To replace the paper you should not wait until you have answered his questions, but should do it as soon as possible after you have read them.

A confident manner and a gift of conversation will help with this trick.

A CRYSTAL RADIO RECEIVING SET

ALTHOUGH directions for making two satisfactory tube receiving sets have been given on pages 335 and 4624, many of the smaller boys still wish to experiment with crystal sets. These are less expensive and give very good results where the construction and hook-up are carefully planned. The amateur maker of a crystal set should avoid sets which offer any difficulties in construction such as are sometimes experienced in winding a tapped coil, in attaching tops to switch points, in attaching a coil wound on a tube to the set or in finishing the set.

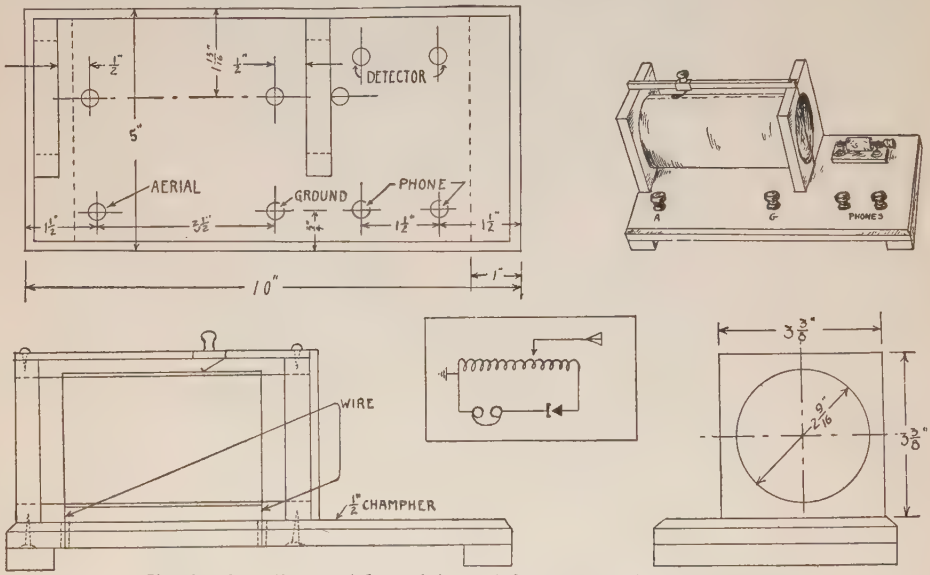
The set illustrated here eliminates most of these difficulties which are encountered in building receiving sets. Instead of using a tapped coil, a slider and rod are used so that the taps, switch points and switch levers may be avoided. The tube used to wind the coil on is an ordinary dry-cell cardboard case, usually $2\frac{9}{16}$ inches in diameter and 6 inches long, which is easily obtainable in this radio age. This tube is small enough in diameter to be fitted into the coil-ends instead of against or on them.

Every neighborhood has at least one expansive bit, which is all that you will find necessary to fit the coil into the coil-ends. Other sets usually require circular disks, or wheels, fastened into the coil, and these in turn are fastened on to the coil-ends. The coil is wound to within 1 inch of each end of the tube, thereby giving the slider enough room to touch the wires on either end of the coil. The coil is wound by hand, so you should have tension on the wire while winding. After the coil is wound it should be given a coat of collodion or shellac.

The coil-ends, base and feet should be completed and assembled and all the holes drilled for binding-posts and detector. Then the coil should be finished by staining and shellacking. After it is all finished and perfectly dry, put the coil in the ends, attach the detector and the binding-posts, and connect up the whole set underneath the base.

To those who cannot read the hook-up the following directions are given: (1) Connect the aerial binding-post to the slider rod. (2) Connect one end of the coil to one side of the detector. (3) Connect the other side of the detector to one phone set. (4) Connect the other phone post to the ground. (5) Connect the other end of the coil to the ground.

Tune in by finding a sensitive spot on the crystal and by sliding over coil to the turn of wire where intensity or volume is greatest. Be sure to scrape carefully the surface of the wires on the coil which comes in the path of the slider so that good contact is assured at every turn. If you follow these directions, your easily made crystal receiving set should prove a real surprise to you and your friends.



Showing how the crystal receiving set is constructed and operated.

SHELLS FOR DECORATIVE PURPOSES

DID you ever collect shells during the summer? The young children of one family living near a large city collected shells enough to inlay the facing around the fireplace of their summer home. These beautiful shells were set in place by the older children, who arranged the largest shells symmetrically in attractive forms, and filled the spaces between with rows of the smaller ones. Only a small portion of the mantelpiece was finished at one time, as the plaster hardened so quickly. The children and their parents are very proud of this decoration as well as of a shell screen which shuts off one end of the long hall.

SOME PUZZLE RHYMES AND VERSES

ALL kinds of puzzles may be worked into rhymes and verses, and it is a very interesting pastime for a rainy day or for a dull evening to solve such puzzle rhymes, and still more interesting to make up original verses of this kind.

For instance, here is a puzzle rhyme:
What is the word referred to in this little verse?

First a *c* and a *t*, last a *c* and a *t*,
With a couple of letters between,
Form a sight that our eyes are delighted to see,
Unless in their sight it is seen.

Here is another similar verse telling how to spell a certain word:

Inscribe an *m* above a line
And write an *e* below,
This woodland flower is hung so fine,
It bends when zephyrs blow.

Dr. Whewell, the great mathematical scholar, once wrote out the following four lines, which can be read as a verse of rhyme. Let us see if we can understand it.

O O N O O
U O A O O I O U
O N O O O O M E T O O
U O A O I D O S O
I O N O O I O U T O O

When we have solved this curious puzzle, we should try to invent some other clever problems of the same kind.

BURIED NAMES

Names may be buried in verses, and it is interesting to dig these out. In this stanza of four lines are buried the names of four animals —that is, the names of the animals are found in the verse spelled properly, the letters running one after the other in their right order.

Poor wretch! a moisture filled his eye,
"Do not rebuff a lonely boy,"
Said he, "If ere I sink and die
Your smile, O! pardon will be joy!"

Here is another stanza in which are buried the names of eight British poets.

The sun is darting rays of gold
Upon the moor. Enchanting spot!
Whose purple heights, by Ronald loved,
Up open to his shepherd cot.
And sundry denizens of air
Are flying, aye, each to his nest;
And eager make at such an hour
All haste to reach the mansions blest.

Who are these eight poets?

In this stanza there are hidden the names of four fruits. What are they?

Go range through every clime, where'er
The patriot muse appears,
He deeds of valour antedates,
His ban an army fears.

ARITHMETIC IN RHYME

Here are some arithmetical problems in rhyme. First of all, who can do this?

Twenty-seven with three nines
You and I can score,
Anyone on other lines
Can extend them more;
Who can write them to be seen
Equal only to sixteen?

A man being asked the ages of himself and his wife when they were married, replied:

When first the marriage knot was tied
Between my wife and me,
My age as oft repeated hers
As three times three does three;
But when ten years and half ten years
We man and wife had been,
Her age came then as near to mine
As eight does to sixteen;
What age was hers, what age was mine.
When we were wed, from this divine.

This is a little problem that is quite easy when you know just how to do it:

A third of six behind them fix
A third of six before,
Thus makes two nines, when all combines
Exactly fifty-four.

A little boy asked his father how old that parent was, to which the father replied:

I was twice as old as you are
The day that you were born;
You will be just what I was then
When fourteen years are gone.

What were the ages of the father and son?

RIDDLES IN RHYME

Some very ingenious riddles can be asked in rhyme. Here is one:

With letters three indite my name,
Add one to show what I became,
Or try to tell what brought me fame.

The name is that of a well-known writer.

Here is another conundrum in verse:

Often talked of, never seen,
Ever coming, never been,
Daily looked for, never here,
Still approaching in the rear.
Thousands for my presence wait,
But, by the decree of fate,
Though expected to appear,
They will never see me here.

What is the solution of this?

SOME CHARADES

It is quite an active mental exercise as well as a pleasant amusement either to write a charade in the form of a rhyme or to solve one. In a charade, as we of course know, a word is taken, each syllable of which has an independent meaning, as in the name Campbell. Here are three clever charades which require a little thought:

My first is a circle, my second a cross;
If you meet with my whole, look out for a toss.

My first makes company,
My second shuns company,
My third assembles company,
My whole puzzles company.

My first I hope you are,
My second I see you are,
My whole I know you are.

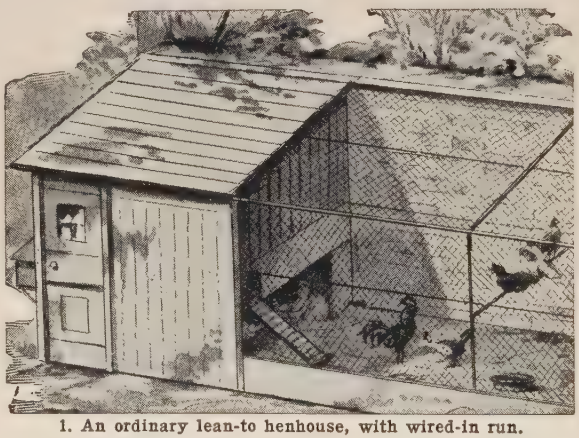
THE SOLUTION OF THESE RHYMES AND PUZZLES WILL BE FOUND ON PAGE 5598.

POULTRY-KEEPING AS A HOBBY

POULTRY-KEEPING as a hobby is comparatively inexpensive, and the new-laid eggs we shall get from time to time will be some recompense for the trouble the chickens entail.

If we decide to keep chickens and think that we are going to make money thereby, we may find ourselves very much mistaken after a few months of experience. When we begin to reckon up the cost of the chickens and the henhouse, with all the little things needed for it, and add up what we have spent upon grain, we may find that the eggs have cost us more than those which we should have purchased at a shop, and that there is nothing for all the time and trouble expended upon the birds.

It may pay to keep chickens if there is plenty of food for them that would otherwise be thrown away, or if there is a yard where they can pick up all they want; but if the greater part of the food has to be purchased, we shall probably find that they are an expense. Therefore, it is not wise for us to imagine that we shall make a large profit from them.



1. An ordinary lean-to henhouse, with wired-in run.

The kind of hens that we should purchase will depend upon two things—whether we wish to have pretty birds, or as many eggs as possible. Let us assume that we desire eggs, in which case we should choose those which are called non-sitting hens, such as Minorcas and Leghorns. These hens lay well and give good-sized, white-shelled eggs. Also, they thrive much better, as a rule, than many other breeds when they are kept in rather confined quarters.

We will now consider the henhouse and wired-in run. This should, if possible, be a wooden building of what is called the lean-to kind—that is to say, it should be as seen in picture 1. The bigger it is, the better. It should be not narrower than 4 feet, and as long as possible. It should be covered on top and at both ends, and, if possible, it should be put up facing the sun. The health of the birds demands that we should give them a proper kind of floor, because if they have a soft earth floor, they are sure to turn sick and die when the wet weather comes. We should first get plenty of big stones, broken brick and other dry rubbish, and spread it over the floor until it is about 6 inches deep. Then we should spread on top of that some gravel, sand and ashes, to the depth of a further 3 inches.

At one end a space should be shut in so as to make a sleeping, or roosting, chamber; and into this we should put perches and nest-boxes, taking care not to crowd the birds unduly. The roosting chamber should be well ventilated. Also, it should have a door communicating with the run, or open-air part, this door being closed at night so as to make the birds cozy and comfortable.

The front of the run should be covered with galvanized wire netting, also seen in picture 1, and there should be a door from the outside into the run, as well as a door from the outside into the roosting chamber.

If the hens are allowed out, they may possibly fly away, and the best way to prevent this is to clip the feathers of one wing. We should cut only the web of the feathers and not the quill. This is not cruel, and it effectually disturbs their balance and thus prevents them from flying. They should not, of course, be given access to flower beds; but if there is provision by which they can have daily exercise without doing any damage, so much the better.

If they are confined to the roosting chamber and the run all the time, it is necessary to give them green food, such as sliced turnips, cabbages or chopped grass. All scraps from the kitchen should be thrown to the chickens. Such scraps, which may include pieces of meat, hard bread and vegetables, should be soaked in water overnight so that they are nice and soft in the morning, which is the best time to give soft food. Three meals a day are enough. At noon vegetables, cooked or green, or cooked maize may be given, but the evening meal should be grain, such as wheat or oats, which ought to be supplied not in a dish, but scattered over the ground so that the birds have to pick it up by scratching for it. There should be some small stones and grit placed in a box in the run, as that helps the birds to digest their food. Flint grit can be purchased cheaply.

Chickens need lime, as it is from the lime which they eat that the shells of their eggs are made. The best form in which to give the lime is crushed shells, especially oyster-shells pounded fine in a mortar.

Water is necessary, and must be supplied in a fountain. Regular drinking-fountains are made of tin or zinc; but an excellent drinking-fountain can be made by placing a bottle full of water upside down in a dish, as seen in picture 2. The lip of the bottle should be raised from the bottom of the dish about 2 inches, and as the water is consumed, or as it evaporates, the level is kept up until the supply in the bottle is exhausted.

The cost of the food for the hens need not be great. It depends upon how much kitchen refuse is available for their feed and also upon whether the grain is bought in small quantities or in large quantities. The latter always works out more cheaply. But if a fair amount of kitchen refuse is available, and if the other food is bought in bulk, the cost should not be more than a nickel a week for each bird.

We have supposed that our hens were to be kept only to provide us with eggs, which is the chief reason why they are kept. But if we want to have our hens lay eggs and hatch them, then we had better have what are called sitting hens. The varieties of chickens that we have already mentioned are not good sitters. Some of the best sitting hens are the kinds known as Rhode Island Reds, Wyandottes, Brahamas, Orpingtons and Plymouth Rocks. But we ought to understand at the outset that if we have only a little space for our chickens in a back yard, it is a mistake to breed chicks. Chicks are apt to sicken and die unless they have plenty of room, such as they get on a farm, and it is far better not to hatch chicks if our space is limited.

2. Drinking-fountain for fowls.

If, however, we place a sitting of eggs under a hen, the young chicks will be hatched in three weeks. The following day the old hen and her brood should be placed out in a coop, and the little chicks should be given baby chick food, which is finely ground. See that plenty of fresh water is always kept within reach of the chicks.

Cleanliness is absolutely necessary in order to keep the chicks in a healthy condition; and the houses, nests and runs should be thoroughly cleansed at least once a week.

HOW TO PRACTICE FLY-CASTING

DO you know that fly-casting is not nearly so difficult as it sounds? A little practice or a few contests with the other boys in the neighborhood will give you the necessary skill. Then, when you are able to make your fly light on the target with considerable accuracy, you are ready to go out for trout, black bass, sunfish, strawberry bass, rock bass or even pickerel. Most game fish are caught with a fly.

Perhaps someone will help you. The reason for using a harmless piece of cloth tied to the end of a line, instead of a real casting-fly with hooks and feathers, is that while learning to cast you should not take any chances on catching the barbs in trees and the like.

The proper rod for fly-fishing for a boy of medium size should be about 8½ feet long; as short as 8 feet for a smaller boy or one who likes a lighter rod; and as long as 9 feet for a taller boy. Split bamboo is best, and may be obtained at low prices; lancewood or steel rods will also do. A plain click reel, which is also inexpensive, is entirely satisfactory. The fly-fishing line should be waterproof silk. A 25-yard line should cost about $1.25.

After you have your equipment, select a smooth bit of yard or field, place your target, which is easily made from a piece of cardboard about 1 foot in diameter, on the ground, and stand off about 20 feet. Have someone watch you and tell you what you do wrong. Later you can do the same for him. First secure the reel in the reel seat, with the handle to the left when the reel is below the rod. Thus, when casting with the right hand, you can easily shorten the line with the left hand. When playing a fish the reel is turned upward and the handle should be to the right, so that the right hand can handle it. The line, through the guides, should be on top of the rod, so that the strain is equally distributed.

Always hold the rod in your right hand, with fingers around the handle and the thumb extended along the top of the hand-grasp. You should be certain to remember this thumb position, as you will fail to make a neat cast without it. Now begin by pointing the rod at the target, with just about enough line out to reach it. Then swing the rod back with a quick motion of forearm and wrist; the upper arm should be kept almost motionless, while the forearm should brush the body.

When your rod has passed just beyond the perpendicular over your head, stop it abruptly. This "back-cast" is marked by a slight pause just at this point, while the line swings out behind. Then keep the back-cast high, with the line always in the air and extended, as this is the secret of an accurate forward cast. This pause before the forward cast should be only slight, as it is immediately followed by a quick snap of the wrist and the forearm, which brings the tip of the rod sharply forward and sends the line out ahead.

Next you will need to learn just how you should aim. It is not directly at the target, as you might think, but three feet or more above it. By keeping your eyes on the target, try to send your cloth fly to a spot above it. Thus, by giving the slightest pause to your line as it reaches the spot above the target, you can cause the fly (cloth) to fall gently on the target instead of slapping down on it. This is the gentle motion you should endeavor to develop because the success in casting depends upon not having a heavy fly to frighten fish, and a light fly is what fish dash for.

After practicing on this 20-foot target until you have accuracy in hitting it, you are ready to place the target farther away. Always remember that accuracy, and not distance, is mainly what you are after. If you learn to hit the target at 20 feet, then 25, and later 30, then a greater distance will come easy. Later the whole process of fly-casting will become automatic, so that you will not need to give it a second thought. It all depends on practice.

Now you can go to the river and cast in earnest. You will now learn quickly which flies to use, and in which places the casting is best. Your success will depend upon that back-yard practice, however, so do not neglect it until you are satisfied with your results. Remember the twist of the wrist counts.

THE GAME OF SNAP

THIS is rather a noisy card game, but it causes great fun. Interest never flags, and the players must be alert all the time. The cards used may be of a special kind in sets of four, each of the cards in each set being alike. Thus we may get four roses or four dahlias in a set; animals may take the place of flowers. But if we do not have such pictorial cards, an ordinary pack of playing-cards will do instead. In such a pack there are four kings, four queens, four aces, and so on.

Now let us begin to play. The more players the merrier the party. The cards are dealt face downward, and no player looks at his cards. When the cards have been dealt the player sitting on the left-hand side of the dealer begins by turning over the top card of his heap and placing it face upward on the table some distance in front of him, and away from his heap. The next player on the first player's left does the same thing with the top card of his pile, and so on round the table, one player after another turning his top card face upward. While this turning-up is going on, if any player notices that a card turned up is the same kind of a card—such as a rose card, a donkey card, or a king card—as the uppermost exposed card in front of himself he calls out "Snap." Whichever of the two players with similar cards calls out the word "Snap" first takes all the turned-up cards in front of the other player, and puts them beneath his unturned heap. Then the game goes on again.

Unless a player is very sharp he will lose heap after heap until all his cards have been taken, when he will be out of the game.

If a player calls "Snap" by mistake, the other player whose card prompted him to call takes all the caller's exposed cards. This prevents players from calling out "Snap" to every card that is turned over, in the hope that it may be like theirs.

As the game proceeds, one after another of the players loses all his cards, until finally there are only two players left in the game. These two players go on until one of them succeeds in winning all the cards of the other player, when the game is at an end.

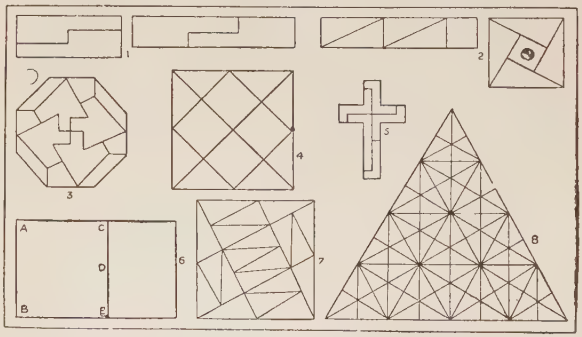
This is a good game to play at parties where boys and girls do not know each other very well. No one has time to be shy because the cards demand every moment of each player's attention. It needs keen eyes and quick observation to avoid losing cards. The excitement often becomes intense and the players will often call "Snap" without meaning to do so.

SOLUTIONS TO THE PUZZLES WITH PAPER

ON page 5337 are given a number of interesting puzzles that can be worked out with scissors and paper. These are the correct solutions to the puzzles. The carpenter who had a plank 4 feet by 1½ feet, and had to fill a hole 6 feet by 1 foot, cutting the wood into only two pieces, did it in the manner shown in picture 1. This was quite easy.

Similarly, the carpenter who had to put a floor into a cupboard which was exactly square, using a plank of wood 15 feet by 3 feet, and cutting this into only five pieces, four of which should be equal, did it as shown in picture 2.

The third puzzle was to cut out four of each of three shapes and fit these together into an octagon. This is done as shown in picture 3. The eight equal squares, four of which are cut into eight triangles, if placed together as shown in picture 4, will form the new square that was required.



1 and 2. The carpenter's puzzles. 3. The octagon. 4. A square made of squares and triangles. 5. The puzzle cross. 6. The folded paper. 7. Square made of 20 triangles. 8. Triangles made of 653 triangles.

In the fifth puzzle there were five pieces of paper, three of which were of the same size and shape, and these had to be put together to form a cross. This is done in the manner shown in picture 5.

The sixth puzzle was very ingenious. The somewhat elaborate cross with stand and candles that was given on the same page had to be built up by folding a single piece of paper in a certain way and making not more than one cut with a pair of scissors. Four folds have to be made before the cutting is done. Suppose picture 6 to be the piece of paper. First of all, mark off the square *A*, *B*, *E*, *C*. Now fold the corner *A* over to *E;* now fold *B* over to *C*, then *C* to *E*, and, finally, from *D* to *E*. The paper thus folded must be cut lengthwise along the centre, and when opened out it will be found to consist of nine pieces of paper, which can quickly be put together to form the cross and candles. In the seventh puzzle a square can be built up from twenty triangles in the manner shown in picture 7. The last puzzle was in some ways the one that gave the greatest scope for cleverness on the part of those trying to solve it. If the twenty-nine lines be drawn as shown in picture 8, it will be seen at once that a very large number of triangles, large and small and of varied shapes, are formed. But not many people would credit the very large number indeed that are thus made. Altogether there are in this large triangle 653 smaller triangles.

THE NEXT THINGS TO MAKE AND TO DO ARE ON PAGE 5593.

Edmund Burke at the trial of Warren Hastings.

HOW DID MEN LEARN TO TALK?

ANYTHING that expresses to someone else what is going on in our minds is, in a way, a sort of talking. We can tell by a baby's face, long before it can talk, something of what it wants and feels. We can also tell by a baby's cry a great deal of what it wants and feels. Now, that cry is made with its voice, just as talking is made, and is really a sort of untaught talking. It is made in the same way, and it serves the same purpose. Different kinds of cries have different meanings. We not only move our faces and make sounds with our voices, but we move our hands and arms. In some parts of the world these movements, or gestures, have definite meanings, and people can talk to each other without saying a word. This is called "gesture language."

In the same way different kinds of sounds—and words are merely sounds—come to have special meanings of their own; that is what happens when we talk. The simplest words are those which babies will make all the world over when they first try to talk. We only have to breathe out through the mouth and separate the lips twice to say "mamma." This, or something very like it, is the baby's name for its mother in all languages, and if men forgot how to talk, the new babies would soon make a beginning with "mamma." Is it not beautiful to think that language began in this way?

One of the interesting questions often asked about talking is why there are so many languages. It is worth thinking about. Very many words really begin in imitation of sounds. You know words like *buzz, whir, pop,* and so on. People who study language know that far more words begin in this way than most people think. Apart from that, however, we often have to make words simply by inventing them. The word does not matter as long as everyone is agreed as to what it means. A word is only a name. A child would still be the same person if he or she had been called Tom instead of Harry, or Monica instead of Marjorie. Shakespeare says in one of the best-known passages in his plays:

> What's in a name?
> A rose by any other name would smell as sweet.

So in different parts of the world different names have been invented; but really different languages are a thousand times more alike than we

think. Latin, Greek, Italian, Spanish, Portuguese and French are really close relatives, because the different peoples who speak them are in large measure descended from the same people. So nowadays we can often learn the history of a nation by its language. English is probably the finest language in the world for all purposes, but it is a very curious mixture. This word "mixture," for instance, is Latin, and so are tens of thousands of English words. Many others are a sort of French, and many others Anglo-Saxon, which is very much like German. We say *father,* the Germans, *vater,* the Romans said *pater,* the French say *père,* and so on. All these words are really the same.

CAN AN IRRESISTIBLE CANNON-BALL KNOCK DOWN AN IMMOVABLE POST?

This is like many other questions that people puzzle themselves over, even grown-up people, who ought to know better. This is a question that cannot be answered for the very good reason that it is a question that cannot be seriously asked by anyone who thinks. A wise man has said that one of the great things wisdom does for us is to teach us how to ask questions, and wisdom certainly teaches us not to ask silly questions like this. Do we not see that the irresistible cannon-ball and the immovable post cannot exist together? When we say *irresistible* cannon-ball, that is as good as saying that there is no post which can resist it. When we say *immovable* post, that is as good as to say that there is no cannon-ball which can knock it down. If either of these things exists, then the other cannot exist. And so, of course, there is no answer to the question, What would happen if they existed together. It is part of the very nature of each of them, as we describe it, that the other could not exist at the same time.

WHY HAVE WE DIFFERENT TASTES IN EATING?

We know that no two people look quite the same. Everyone's face is differently made from every other face. We know that when we take prints of the markings on people's fingers they always differ from one another. We have never yet found two finger-prints in different people that were quite the same. And, as people differ in their faces and in their skins, so they differ in deeper things. No two brains are quite the same, and so no two people have quite the same tastes. But there are other reasons why people have different tastes in eating. Different people's bodies have different needs. One person's body may require a good deal of fat and may be very capable of digesting fat. That person will like fat and oily things—which may be less good for another, who will like it less. Then, again, at different ages we have different food requirements. Children are very active, and since they are small, lose their heat quickly. They therefore require a large proportion of food to supply them with energy and heat. Perhaps the best of such foods is sugar, and that is the good reason why children and young people like sweet things more than most grown-up people do. This is not greed, but the demand of the body for what it specially needs. Thus tastes differ, too, in different parts of the world. A child from the Arctic region will enjoy blubber and oil, which would not suit a child from the temperate zones.

WHY DOES GRASS TURN YELLOW AFTER BEING MADE INTO HAY?

If there were no microbes in the world this would not happen; but nearly all the changes that happen in the bodies of living things after they die are due to microbes. This is as true of fish that turns bad as of grass that turns yellow when it is made into hay. Perhaps we are apt to forget that grass is part of the body of a living thing, but so it certainly is. It consists of those parts of certain plants which are called their leaves.

These leaves, like all other leaves, have the special duty of feeding on the carbon dioxid of the air by the aid of sunlight. For this purpose they contain a very wonderful chemical substance called *chlorophyl,* the color of which is green. Like all other chemical compounds which are very complicated, chlorophyl is very easily broken up and changed into something else. On the other hand, most simple compounds, like water, are very difficult to break up.

When the leaves of grass die by being cut, the very first compound that suffers from the change is this delicate and unstable chlorophyl. It is broken up into compounds some of which have a yellow color. We see the same thing in the leaves of a tree in autumn, which the tree has killed by corking up the channels through which they got their food.

WHY ARE CANS FOR PRESERVING FOOD GENERALLY ROUND?

Round cans are easier to make than square cans, but the main reason for making this shape is that it embodies the principle of the arch, which helps greatly to give strength. A round can will stand a great deal of knocking about and a great deal of pressure without losing its shape. It has no corners to become battered or dented.

DO ALL THINGS MOVE IN SPACE?

Of course the sun and the moon, and even what used to be called the "fixed stars," have motions of their own—their *proper* motions, as they are called, "proper" really meaning "belonging to." The motion which proves that the earth is moving is called their *apparent* motion, for it only seems, or "appears." The earth is moving, and not they. This motion is *common* to *all* the heavenly bodies, though their proper motions may all be quite different from each other; and it is *diurnal,* which is Latin for "daily." The best proof of the earth's motion, then, is the *common, apparent, diurnal* motion of the heavenly bodies, which can only mean that the earth spins right round on itself once a day; just as the best proof of a train's motion is the *common, apparent* motion of everything on both sides of it —common, or shared in by all objects, even though these may include cows or horses running in opposite directions to each other. That, of course, is their own, or *proper,* motion. Everything moves.

WHY DOES RED IRRITATE A BULL?

It is very difficult to be quite sure of the truth of this question, and we ought to be sure of the fact before we try to explain it. No one has made experiments to prove that red really irritates the bull more than any other bright color. Still, it is probable that red, perhaps just because it is usually the brightest of colors, does irritate a bull; though if the red color were on something that did not move, perhaps it would have much less effect. People have thought that bulls are irritated by red because it is the color of blood; but we do not think that is so. A certain amount of study of human beings seems to suggest that different colors differ in their effect on the nervous system. While such colors as green and violet are soothing, yellow and red are exciting. Of course, it takes very little to irritate a bull; so the saying is popular.

DOES A BRIDGE EXPAND IN THE SUN?

A bridge expands in the sun and in the daytime and in the summer, and shrinks in the shade and at night and in winter. The rule is that heat makes everything expand, while cold makes everything shrink. Cold is nothing but the absence of heat. So we may say that everything occupies more or less space according to the amount of heat in it—that is, of course, if other circumstances, such as the pressure around the thing, are kept the same. Metals have a way of changing their volume, or size, under the influence of heat. This change is very noticeable in the case of the iron and steel bridges built nowadays. If the engineer does not know that bridges expand in the sun, he will build a bridge that is certain soon to get strained and even to crack. He has to reckon on the amount of expansion that will occur under the influence of such heat as the bridge is likely to be exposed to, and he must allow for it. In a big bridge many inches have to be allowed for change of size when hot or cold.

HOW DO WE KNOW THAT THE EARTH IS IN MOTION?

We have in recent years found a new way of showing that the earth is in motion. We start something spinning, like a top, and showing that it seems to change the direction of its spin in a way which can only mean that the earth on which it spins is itself spinning. But it was known that the earth is in motion long before this way of showing it was found. We know that it is moving just as we know that even the smoothest train is moving—by the fact that other things seem to move beside it. In the case of the train, these other things are the telegraph poles and fields and hedges. In the case of the earth, the other things are the sun, moon and stars, and even comets, when there are comets to be seen. All the heavenly bodies seem to rise in the east and set in the west. It is impossible that this can mean anything else but that the earth spins toward the sun, moon and stars as they seem to rise, and away from them as they seem to set.

DOES SMOKE ALWAYS COME FROM A FIRE?

There is no real reason why smoke should always come from a fire, and already there are many ways of making

fires which produce no smoke. The time is not very far off when no one will be allowed to make fires that produce smoke. The reason why smoke comes from our ordinary fires is the same as the reason for a great many other facts that we can notice. It is, indeed, the reason which explains the making of the coal in the first place. Carbon will not burn unless it is hot enough, and it is less easily burned than most of the other things that can burn. A certain quantity of carbon is apt to go unburned, though this will happen far less if we keep the fire hot enough, which is to be done by giving it a good supply of air. If we make a forced draft, and keep up a steady, quick flow of fresh air—that is to say, of fresh oxygen—to the fire, then we shall find that all the carbon is burned up, and no smoke will be produced. Smoke is always a sign of failure and waste, even if there were nothing worse to say about its consequences.

WHY CANNOT WE SEE THE SPOKES OF A WHEEL WHEN IT GOES VERY FAST?

The reason is that the marks made, so to speak, by anything on the retina at the back of the eye do not instantly fade away, but last for a small fraction of a second. The real marvel here is that these images on the retina last for such a short time, and that it is so quickly ready to receive new ones. Still, the images do last for a little while, and if a wheel goes round at all quickly, the marks made by the spokes at the different parts of their journey run into each other, and we see no distinct spokes at all, but only a faint blur inside the circle of the wheel. The first answer to this question that would naturally suggest itself to our minds is that the spokes of the wheel cannot be seen when it turns quickly because they are moving too fast for the eye to catch. That, however, is not the case at all. A simple experiment will show that the first explanation is the true one, and not the second, likely though it sounds. If we set a wheel spinning in darkness and then turn on the electric light just for an instant, we catch a glimpse of the spokes of the wheel all seeming fixed in one place, as if the wheel were not moving at all.

WHY DOES GLASS NOT BREAK IF PUT IN COLD WATER AND BOILED?

Almost everything gets bigger, or *expands,* when it is made hot; and it gets smaller, or *contracts,* when made cool. If, then, we take a thing all in one piece and do not heat every part of it to the same extent at the same time, something will have to go. That is what happens when a tumbler is cracked in the way we all know. If the tumbler is put into water, and then the water is boiled, all the parts of the glass expand equally as it gets hotter. The whole glass becomes bigger. There is no strain between the inside and the outside, and so there is no reason why it should break.

WHY IS THE SKY BLUE?

This was found out last century by John Tyndall. The sky gets its light from the sun. When the sun is away the sky is dark. Therefore the blue of the sky must be somehow thrown to our eyes from something in the sky which keeps all the other colors in the white light of the sun and throws back the blue. That is what happens.

The sky is filled with countless tiny specks of what we may call dust, specks of solid stuff hanging in the air. These are of just such a size that they catch the bigger waves of light, which make the other colors, but throw to our eyes the shorter waves of light, which make blue. If we could do away with all the solid stuff in the air, the sky would be dark, and all the light of the daytime would come directly from the sun. Sky light is reflected sunlight, but only the blue part.

HOW CAN A DUCKLING SWIM WITHOUT BEING TAUGHT?

The answer is: Partly by instinct. It is only fair to remember that in any case it is much easier for animals to swim than it is for us; and it is also fair to us to remember that some people do swim almost without being taught. Sometimes an insect which has never seen anyone do the thing it has to do, does it perfectly; but in the case of the higher animals, like the cat and the duckling, the question of being taught comes in. The kitten may learn to purr partly through hearing its mother purr, and the duckling, though perhaps its mother does not actually teach it anything, gets confidence from its mother. It knows she is there, and it sees that she can swim, and that helps it.

CAN PEOPLE TELL OUR FORTUNES?

There is a way in which people can tell our fortunes, and there is another way in which they cannot. No one can be cer-

tain of the future, but if we find that a man is strong and true and persevering, we know that certain things are very likely to be done by him. If we find that he eats and drinks too much, is lazy, cowardly and cruel, we can, in a sense, predict his fortune also. People who pretend to tell fortunes manage to get a certain amount of success because chance makes them right in certain cases, and because they study, as carefully as they can, the character of the people who come to them. They know the tremendous truth that a man's character is his destiny; and so, if they can tell his character, they can tell his fortune. But they cannot by any means tell a single one of the things for which foolish people go to them.

SHOULD WE BE AFRAID TO DIE?

No animal is afraid to die, but that is because it does not think of the future, and cannot know what death is. A child does not *naturally* fear to die, though we can easily make ourselves afraid. For ages past many men have made it their business, for one reason or another, to teach people to be afraid to die. This applies only to our part of the world. In Asia, where the greater number of all mankind is still to be found, men are not afraid of death, but in our part of the world they are, and for two reasons. The first is that usually we are taught that death is painful. A natural death is no more painful than going to sleep. In both cases we slowly lose our feelings, because the amount of carbon dioxid and other substances in the brain prevent it from feeling any more. Nature is most merciful in this respect. It is the rarest of events for a death to be other than a quiet, peaceful going to sleep, from which there is no waking here—a scene painful to the lookers-on, but not to the dying person.

Then men fear to die because of "the dread of something after death." Only the wisest of us, and those who believe in their hearts what they profess to believe with their lips, know that "to the good man no evil thing can happen."

WHY DOES EVERYTHING SPIN ROUND WHEN WE ARE DIZZY?

When anyone feels dizzy and perhaps almost about to faint, his brain cannot properly control the working of his eyes. They may move around from side to side, perhaps independently instead of together. So it may look as if things were spinning round. Another reason for dizziness has to do with a wonderful part of the body near the ear without which none of us could sit upright, much less stand, though few people have ever heard of it. This organ, which it used to be thought had something to do with hearing, really controls our balance. In some people it suffers from a disease, and these people constantly suffer from dizziness and an unpleasant feeling that everything is spinning round.

As every child knows, we can make ourselves dizzy by turning ourselves around several times in one direction. This disturbs the organ of balance about which we have been speaking, and this disturbance it is that gives us the dizzy feeling. If you turn around the other way, you put things right by restoring the original state of affairs within the balancing organ. The name for the feeling that things are spinning round is *vertigo; vert* simply means "turn."

WHAT DOES BIRTHRIGHT MEAN?

In nearly every part of the world, at one time or another, alike among savages and among civilized people, the eldest son had special rights and privileges over the others. He inherited most or all of his father's property, and had a special right to his father's title and position, whether as chief of a savage tribe or as a duke or king, or as holding some other title or dignity.

This right of the first-born was called his birthright, and the Bible story of Esau and Jacob is sufficient to tell us how old this custom is. It has a special long name which we shall certainly meet sometimes, and which we must therefore learn. This right of the first-born still in vogue in England, Italy, Spain and other countries is called the right of *primogeniture*. In many countries this law of birthright has been abolished, and sons inherit equally and have equal rights. France led the way in this respect, probably as a protest against the ancient custom of titles being transferred from father to eldest son. In the United States and Canada there is no law of primogeniture.

DO SEEDS BREATHE JUST AS PEOPLE DO?

Seeds are no exception to the rule that every living thing must breathe. Nor are eggs. Perhaps you have never

thought that an egg is alive? But if you varnish an egg so that no air can get through the shell, it will die, and no chicken will come out of it. The seed gets its air, or, rather, its oxygen from the air, as the worm does. You must not plant a seed too deeply, or it will not get enough air and will die. You may wonder that a seed should breathe, but that is because we always think of breathing as if breathing could be done only with ribs and lungs, as we do it.

DOES A FLOWER SLEEP AT NIGHT?

Plants do go to sleep at night for several interesting reasons. Animals depend on plants and trees for the air they breathe, and plants and trees depend on animal life for theirs. Plants take in the carbon dioxid from the air, using the carbon and giving out the oxygen, thus forming material for the life of animals. Animals, that is, men and beasts, breathe out carbon dioxid, and so keep the air fit for the life of plants. We could not live without plants, and plants would die but for us.

But when the sun is shining, or so long as light lasts, the plant is so busy taking in its store of carbon dioxid that it has not time to put forth the oxygen due from it. When the daylight dies away, the plant ceases to take in the carbon, and, while sleeping, gives off its oxygen. A flower takes its food in the day and grows at night. It becomes heavier during the day, but lighter during the night, when it is giving off and not taking in anything.

But we must not suppose that plants sleep only at night. Some sleep during the day and wake up in the evening. Pollen has to be brought to many plants by insects. Some insects sleep by day and work by night. They are the ones that visit the night flowers, carrying the pollen which they need.

Then there are early-risers among the flowers. The crocus, for instance, wakes early and goes to sleep soon after midday. Plants and flowers seem to know as well as the wisest of human beings what best to do. Some are so delicate that they cannot bear the glare of the hot sun, so they go to sleep before the heat becomes too great for them, closing their petals and protecting their sensitive parts. Others cannot bear much moisture or cooling, and they go to sleep and keep snug until all is safe again.

For the most part it is at night that the plants sleep. The flowers close their petals with wonderful neatness; the leaves curl; some stalks hang limp, while the stalks of others, in order to let out the oxygen, have to keep erect, as we do when we wish to breathe deeply.

FOR WHAT PURPOSES IS GOLDBEATER'S SKIN USED?

Goldbeater's skin is made from the peritoneum of the ox, a skin which protects the internal organs and acts as a wall to the abdomen. Its chief use, and indeed the use which gave goldbeater's skin its name, is in connection with the making of gold leaf. The gold leaf used for gilding is real gold, or sometimes an alloy of gold and another metal, which has been treated to annealing and hammering processes until it is about only one 290,000th of an inch thick. After several preliminary processes, small, thin squares of gold are placed in a pile and between special paper, and are then hammered. As the gold becomes thinner it spreads out. It is then cut into smaller pieces, piled between sheets of goldbeater's skin, and is again hammered. This process is repeated two or three times, goldbeater's skin being the separating material for each successive hammering, which becomes lighter as the leaf becomes thinner, till the desired degree of thinness is reached. Goldbeater's skin is used also for the making of ballonets for airships, but its most familiar use is in the home for the treatment of cuts.

Goldbeating is one of the oldest of the arts, and is thought to have originated among the Eastern nations. Homer wrote about it in his great poems. On mummy-cases taken from the tombs of the ancient Egyptian kings there have been found examples of gilding. The goldleaf of the ancients was about three times as thick as the goldleaf of to-day.

WHY DO LEAVES CHANGE COLOR IN THE AUTUMN?

In the autumn the beautiful green stuff made by the sunlight in the plant changes and goes. It is not that the plant is dying, but that it is going to rest for the winter. As it is not going to use its leaves, it takes out of them everything that will be useful. In doing this the plant or the tree changes the green stuff in the leaf, and so we get various colors produced in the autumn.

THE NEXT WONDER QUESTIONS ARE ON PAGE 5613.

KING BRUCE AND THE SPIDER

ELIZA COOK, a busy writer, both of prose and verse, was born in 1818 and died in 1889. She was not in any sense a remarkable poet, and the following verses, chosen for the Book of Poetry, owe their interest as much, indeed more, to the legend they relate than to the manner of its telling. They tell us never to give up, but, like Bruce, to "try, try, try again."

KING BRUCE of Scotland flung
himself down
In a lonely mood to think;
'Tis true he was monarch, and wore a crown,
But his heart was beginning to sink.

For he had been trying to do a great deed,
To make his people glad;
He had tried, and tried, but couldn't succeed;
And so he became quite sad.

He flung himself down in low despair,
As grieved as man could be;
And after a while as he ponder'd there,
"I'll give it all up," said he.

Now just at that moment a spider dropp'd
With its silken cobweb clue;
And the King in the midst of his thinking stopp'd
To see what that spider would do.

'Twas a long way up to the ceiling dome,
And it hung by a rope so fine,
That how it would get to its cobweb home
King Bruce could not divine.

It soon began to cling and crawl
Straight up with strong endeavour;
But down it came with a slippery sprawl,
As near the ground as ever.

Up, up it ran, not a second it stay'd
To utter the least complaint;
Till it fell still lower, and there it laid,
A little dizzy and faint.

Its head grew steady—again it went,
And travell'd a half-yard higher;
'Twas a delicate thread it had to tread,
A road where its feet would tire.

Again it fell and swung below,
But again it quickly mounted;
Till up and down, now fast, now slow,
Nine brave attempts were counted.

"Sure," cried the King, "that foolish thing
Will strive no more to climb;
When it toils so hard to reach and cling,
And tumbles every time."

But up the insect went once more,
Ah, me! 'tis an anxious minute;
He's only a foot from his cobweb door,
Oh, say, will he lose or win it!

Steadily, steadily, inch by inch,
Higher and higher he got;
And a bold little run at the very last pinch
Put him into his native cot.

"Bravo, bravo!" the King cried out,
"All honour to those who *try;*
The spider up there defied despair,
He conquer'd, and why shouldn't I?"

And Bruce of Scotland braced his mind,
And gossips tell the tale,
That he tried once more as he tried before,
And that time did not fail.

Pay goodly heed, all ye who read,
And beware of saying, "I *can't.*"
'Tis a cowardly word, and apt to lead
To Idleness, Folly, and Want.

Whenever you find your heart despair
Of doing some goodly thing,
Con over this strain, try bravely again,
And remember the Spider and King.

THE THREE FISHERS

In this fine poem by Charles Kingsley the tragic fate that so often awaits the toilers of the sea is described with great dramatic power. We cannot read it without a feeling of sympathy for the fisherfolk, and especially for their womenkind, who have to wait with anxious hearts at home when the storm has overtaken their loved ones on the deep.

THREE fishers went sailing away to the West,
Away to the West as the sun went down;
Each thought on the woman who loved him the best,
And the children stood watching them out of the town;
For men must work, and women must weep,
And there's little to earn, and many to keep,
Though the harbour-bar be moaning.

Three wives sat up in the lighthouse tower,
And trimmed the lamps as the sun went down,
And they looked at the squall, and they looked at the shower,
And the night rack came rolling up, ragged and brown;
But men must work, and women must weep,
Though storms be sudden, and waters deep,
And the harbour-bar be moaning.

Three corpses lay out on the shining sands,
In the morning gleam as the tide went down,
And the women are watching and wringing their hands,
For those who will never come home to the town,
For men must work, and women must weep,
And the sooner it's over, the sooner to sleep,
And good-bye to the bar and its moaning.

THE LAST CHARGE OF THE FRENCH AT WATERLOO

Sir Walter Scott, the author of the Waverley Novels, is always seen at his best, both in poetry and in prose, where he is picturing in vivid words the excitement of the fray when a battle is at its most critical moment. In these lines we see how alive his verse could be under the inspiration of his subject.

ON came the whirlwind—like the last
But fiercest sweep of tempest-blast—
On came the whirlwind—steel-gleams broke
Like lightning through the rolling smoke;
The war was waked anew,
Three hundred cannon-mouths roar'd loud,
And from their throats, with flash and cloud,
Their showers of iron threw.
Beneath their fire, in full career,
Rush'd on the ponderous cuirassier,
The lancer couch'd his ruthless spear,
And hurrying as to havoc near,
The cohorts' eagles flew.
In one dark torrent, broad and strong,
The advancing onset roll'd along,
Forth harbinger'd by fierce acclaim,
That, from the shroud of smoke and flame,
Peal'd wildly the imperial name!

But on the British heart were lost
The terrors of the charging host;
For not an eye the storm that view'd
Changed its proud glance of fortitude.
Nor was one forward footstep stay'd
As dropp'd the dying and the dead.
Fast as their ranks the thunders tear,
Fast they renew'd each serried square;
And on the wounded and the slain
Closed their diminish'd files again,
Till from their line scarce spears lengths three,
Emerging from the smoke they see
Helmet, and plume, and panoply—
Then waked their fire at once!
Each musketeer's revolving knell,
As fast, as regularly fell,
As when they practise to display
Their discipline on festal day.
Then down went helm and lance,
Down were the eagle-banners sent,
Down reeling steeds and riders went,
Corslets were pierced, and pennons rent;
And to augment the fray,
Wheel'd full against their staggering flanks,
The English horsemen's foaming ranks
Forced their resistless way.
Then to the musket-knell succeeds
The clash of swords, the neigh of steeds—
As plies the smith his clanging trade,
Against the cuirass rang the blade;
And while amid their close array
The well-served cannon rent their way,
And while amid their scatter'd band
Raged the fierce rider's bloody brand,
Recoil'd in common rout and fear
Lancer and guard and cuirassier,
Horsemen and foot,—a mingled host!
Their leaders fall'n, their standards lost.

THE HORSE

To Miss Jane Taylor we owe many pleasant little poems on the most familiar things of everyday life. In giving this example from her pen, it may be remarked that this used to be a favorite piece in the school-books thirty or forty years ago, but its quiet humor and the lesson it teaches are still worthy of the attention of the young reader.

A HORSE long used to bit and bridle,
But always much disposed to idle,
Had often wish'd that he was able
To steal unnoticed from the stable.

He panted from his inmost soul,
To be at nobody's control,
Go his own pace, slower or faster,
In short, do nothing—like his master.

But yet he ne'er had got at large,
If Jack (who had him in his charge)
Had not, as many have before,
Forgot to shut the stable-door.

Dobbin, with expectation swelling,
Now rose to quit his present dwelling,
But first peep'd out with cautious fear,
To examine if the coast were clear.

At length he ventured from his station,
And with extreme self-approbation,
As if deliver'd from a load,
He gallop'd to the public road.

And here he stood awhile debating
(Till he was almost tired of waiting),
Which way he'd please to bend his course,
Now there was nobody to force.

At last uncheck'd by bit or rein,
He saunter'd down a pleasant lane,
And neigh'd forth many a jocund song,
In triumph, as he pass'd along.

But when dark night began t'appear,
In vain he sought some shelter near,
And well he knew he could not bear
To sleep out in the open air.

The grass felt very damp and raw,
Much colder than his master's straw;
Yet on it he was forced to stretch
A poor cold, melancholy wretch.

The night was dark, the country hilly,
Poor Dobbin felt extremely chilly,
Perhaps a feeling like remorse,
Just then might sting the truant horse.

As soon as day began to dawn,
Dobbin, with long and weary yawn,
Arose from this his sleepless night,
But in low spirits and bad plight.

If this (thought he) is all I get,
A bed unwholesome, cold and wet,
And thus forlorn about to roam,
I think I'd better be at home.

'Twas long ere Dobbin could decide
Betwixt his wishes and his pride,
Whether to live in all this danger,
Or go back sneaking to the manger.

At last his struggling pride gave way;
The thought of savoury oats and hay
To hungry stomach was a reason
Unanswerable at this season.

So off he set with look profound,
Right glad that he was homeward bound;
And, trotting fast as he was able,
Soon gain'd once more his master's stable.

Now Dobbin after this disaster,
Never again forsook his master,
Convinced he'd better let him mount,
Than travel on his own account.

ROBERT OF LINCOLN

Robert of Lincoln is considered one of the finest bird poems ever written; it is by William Cullen Bryant, the American poet.

MERRILY swinging on brier and weed,
Near to the nest of his little dame,
Over the mountain-side or mead,
Robert of Lincoln is telling his name.
Bob-o'-link, bob-o'-link,
Spink, spank, spink,
Snug and safe in this nest of ours,
Hidden among the summer flowers.
Chee, chee, chee.

Robert of Lincoln is gayly dressed,
Wearing a bright, black wedding-coat;
White are his shoulders, and white his crest.
Hear him call his merry note,
Bob-o'-link, bob-o'-link,
Spink, spank, spink,
Look what a nice new coat is mine;
Sure there was never a bird so fine.
Chee, chee, chee.

Robert of Lincoln's Quaker wife,
Pretty and quiet with plain brown wings,
Passing at home a patient life,
Broods in the grass while her husband sings,
Bob-o'-link, bob-o'-link,
Spink, spank, spink,
Brood, kind creature, you need not fear
Thieves and robbers while I am here.
Chee, chee, chee.

Modest and shy as a nun is she;
One weak chirp is her only note;
Braggart, and prince of braggarts is he,
Pouring boasts from his little throat,
Bob-o'-link, bob-o'-link,
Spink, spank, spink,
Never was I afraid of man,
Catch me, cowardly knaves, if you can!
Chee, chee, chee.

Six white eggs on a bed of hay,
Flecked with purple, a pretty sight:
There as the mother sits all day,
Robert is singing with all his might,
Bob-o'-link, bob-o'-link,
Spink, spank, spink,
Nice good wife that never goes out,
Keeping house while I frolic about.
Chee, chee, chee.

Soon as the little ones chip the shell,
Six white mouths are open for food;
Robert of Lincoln bestirs him well,
Gathering seeds for the hungry brood:
Bob-o'-link, bob-o'-link,
Spink, spank, spink,
This new life is likely to be
Hard for a gay young fellow like me.
Chee, chee, chee.

Robert of Lincoln at length is made
Sober with work, and silent with care,
Off is his holiday garment laid,
Half forgotten that merry air,
Bob-o'-link, bob-o'-link,
Spink, spank, spink,
Nobody knows but my mate and I,
Where our nest and our nestlings lie.
Chee, chee, chee.

Summer wanes; the children are grown;
Fun and frolic no more he knows,
Robert of Lincoln's a hum-drum drone;
Off he flies, and we sing as he goes,
Bob-o'-link, bob-o'-link,
Spink, spank, spink,
When you can pipe that merry old strain,
Robert of Lincoln, come back again.
Chee, chee, chee.

THE HORNED OWL

In this poem Barry Cornwall gives us a more sympathetic and friendly description of the bird of night than poets, as a rule, are inclined to devote to the owl. His poem also conveys a thought that is worth thinking over. It reminds us that, although we may be apt to consider the owl a lonely bird, we are wrong in thinking so, for there is a companionship of the night as of the day.

IN the hollow tree, in the old grey tower,
The spectral owl doth dwell;
Dull, hated, despised in the sunshine hour;
But at dusk he's abroad and well:
Not a bird of the forest ere mates with him;
All mock him outright by day;
But at night, when the woods grow still and dim
The boldest will shrink away.
Oh, when the night falls, and roosts the fowl,
Then, then is the reign of the hornèd owl!

And the owl hath a bride who is fond and bold,
And loveth the wood's deep gloom:
And with eyes like the shine of the moonshine cold
She awaiteth her ghastly groom!
Not a feather she moves, not a carol she sings,
As she waits in her tree so still:
But when her heart heareth his flapping wings,
She hoots out her welcome shrill!
Oh, when the moon shines and dogs do howl,
Then, then is the joy of the hornèd owl.

Mourn not for the owl nor his gloomy plight!
The owl hath his share of good:
If a prisoner he be in the broad daylight,
He is lord in the dark green wood!

Nor lonely the bird, nor his ghastly mate;
They are each unto each a pride—
Thrice fonder, perhaps, since a strange dark fate
Hath rent them from all beside!
So when the night falls, and dogs do howl,
Sing ho! for the reign of the hornèd owl!
We know not alway
Who are kings by day,
But the king of the night is the bold brown owl.

THE OVERLAND MAIL

This poem by Rudyard Kipling shows us the hero in the man who performs the common everyday services of life.

IN the name of the Empress of India, make way,
O lords of the jungle wherever you roam,
The woods are astir at the close of the day—
We exiles are waiting for letters from home—
Let the robber retreat; let the tiger turn tail,
In the name of the Empress, the Overland Mail.

With a jingle of bells as the dusk gathers in,
He turns to the footpath that leads up the hill—
The bags on his back, and a cloth round his chin,
And, tuck'd in his belt, the Post-Office bill—
"Despatch'd on this date, as received by the rail,
Per runner, two bags of the Overland Mail."

Is the torrent in spate? He must ford it or swim.
Has the rain wreck'd the road? He must climb by the cliff.
Does the tempest cry "Halt"? What are tempests to him?
The service admits not a "but" or an "if";
While the breath's in his mouth, he must bear without fail,
In the name of the Empress, the Overland Mail.

From aloe to rose-oak, from rose-oak to fir,
From level to upland, from upland to crest,
From rice-field to rock-ridge, from rock-ridge to spur,
Fly the soft-sandall'd feet, strains the brawny brown chest,
From rail to ravine—to the peak from the vale—
Up, up through the night goes the Overland Mail.

There's a speck on the hillside, a dot on the road—
A jingle of bells on the foot-path below—
There's a scuffle above in the monkeys' abode—
The world is awake, and the clouds are aglow—
For the great sun himself must attend to the trail;
In the name of the Empress, the Overland Mail.

MY MARYLAND

This poem was written by James Ryder Randall, a native of the state, when he heard of the skirmish which took place in Baltimore as the Federal troops were passing through. It spread over the whole South, but its appeal was in vain.

THE despot's heel is on thy shore,
Maryland!
His torch is at thy temple door,
Maryland!
Avenge the patriotic gore
That flecked the streets of Baltimore,
And be the battle-queen of yore,
Maryland, my Maryland!

Hark to an exiled son's appeal,
Maryland!
My Mother State, to thee I kneel,
Maryland!
For life and death, for woe and weal,
Thy peerless chivalry reveal,
And gird thy beauteous limbs with steel,
Maryland, my Maryland!

Thou wilt not cower in the dust,
Maryland!
Thy beaming sword shall never rust!
Maryland!
Remember Carroll's sacred trust,
Remember Howard's warlike thrust,
And all thy slumberers with the just,
Maryland, my Maryland!

Come! 'tis the red dawn of the day,
Maryland!
Come with thy panoplied array,
Maryland!
With Ringgold's spirit for the fray,
With Watson's blood at Monterey,
With fearless Lowe and dashing May,
Maryland, my Maryland!

Dear mother, burst the tyrant's chain,
Maryland!
Virginia should not call in vain,
Maryland!
She meets her sisters on the plain—
"Sic semper!" 'tis the proud refrain
That baffles minions back amain,
Maryland, my Maryland!

Come! for thy shield is bright and strong,
Maryland!
Come! for thy dalliance does thee wrong,
Maryland!
Come to thine own heroic throng
Stalking with Liberty along,
And chant thy dauntless slogan-song,
Maryland, my Maryland!

I saw the blush upon thy cheek,
Maryland!
For thou wast ever bravely meek,
Maryland!
But lo! there surges forth a shriek,
From hill to hill, from creek to creek,
Potomac calls to Chesapeake,
Maryland, my Maryland!

Thou wilt not yield the Vandal toll,
Maryland!
Thou wilt not crook to his control,
Maryland!
Better a fire upon thee roll,
Better the shot, the blade, the bowl,
Than crucifixion of the soul,
Maryland, my Maryland!

Dear mother, burst the tyrant's chain,
Maryland!
Virginia should not call in vain,
Maryland!
She meets her sisters on the plain—
"Sic semper!" 'tis the proud refrain
That baffles minions back amain,
Maryland!
Arise in majesty again,
Maryland, my Maryland!

THE OLD WOMAN AND HER PIG

AN old woman was sweeping her house, and she found a little crooked sixpence. "What," she said, "shall I do with this little sixpence? I shall go to market and buy a little pig." As she was coming home she came to a stile. The piggy would not go over the stile. She went a little farther, and she met a dog, so she said to the dog:

"Dog, dog, bite pig,
Piggy won't get over the stile,
And I sha'n't get home to-night!"
But the dog would not.

SHE went a little farther, and she met a stick. So she said:
"Stick, stick, beat dog;
Dog won't bite pig,
Piggy won't get over the stile,
And I sha'n't get home to-night!"
But the stick would not.

SHE went a little farther, and she met a fire. So she said:
"Fire, fire, burn stick;
Stick won't beat dog;
Dog won't bite pig;
Piggy won't get over the stile,
And I sha'n't get home to-night!"
But the fire would not.

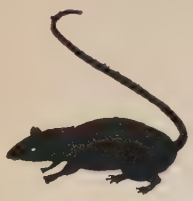
SHE went a little farther, and she met some water. So she said:
"Water, water, quench fire;
Fire won't burn stick;
Stick won't beat dog;
Dog won't bite pig;
Piggy won't get over the stile,
And I sha'n't get home to-night!"
But the water would not.

SHE went a little farther, and she met an ox.
So she said:
"Ox, ox, drink water;
Water won't quench fire;
Fire won't burn stick;
Stick won't beat dog;
Dog won't bite pig;
Piggy won't get over the stile,
And I sha'n't get home to-night!"
But the ox would not.

SHE went a little farther, and she met a butcher.
So she said:
"Butcher, butcher, kill ox;
Ox won't drink water;
Water won't quench fire;
Fire won't burn stick;
Stick won't beat dog;
Dog won't bite pig;
Piggy won't get over the stile,
And I sha'n't get home to-night!"
But the butcher would not.

SHE went a little farther, and met a rope. So she said:
"Rope, rope, hang butcher;
Butcher won't kill ox;
Ox won't drink water;
Water won't quench fire;
Fire won't burn stick;
Stick won't beat dog;
Dog won't bite pig;
Piggy won't get over the stile,
And I sha'n't get home to-night!"
But the rope would not.

SHE went a little farther, and she met a rat. So she said:



"Rat, rat, gnaw rope;
Rope won't hang butcher;
Butcher won't kill ox:
Ox won't drink water;
Water won't quench fire;
Fire won't burn stick;
Stick won't beat dog;
Dog won't bite pig;
Piggy won't get over the stile,
And I sha'n't get home to-night!"

But the rat would not.

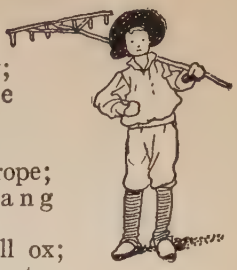
SHE went a little farther, and she met a cat. So she said:

"Cat, cat, kill rat;
Rat won't gnaw rope;
Rope won't hang butcher;
Butcher won't kill ox;
Ox won't drink water;
Water won't quench fire;
Fire won't burn stick;
Stick won't beat dog;
Dog won't bite pig;
Piggy won't get over the stile,
And I sha'n't get home to-night!"

BUT the cat said to her, "If you will go to yonder cow, and fetch me a saucer of milk, I will kill the rat." So away went the old woman to the cow, and said:

"Cow, cow, give me a saucer of milk;
Cat won't kill rat;
Rat won't gnaw rope;
Rope won't hang butcher;
Butcher won't kill ox;
Ox won't drink water;
Water won't quench fire;
Fire won't burn stick;
Stick won't beat dog;
Dog won't bite pig;
Piggy won't get over the stile,
And I sha'n't get home to-night!"

BUT the cow said to her, "If you will go to yonder haymakers, and fetch me a wisp of hay, I'll give you the milk." So away went the old woman to the haymakers, and said:



"Haymakers,
give me a
wisp of hay;
Cow won't give
milk;
Cat won't kill rat;
Rat won't gnaw rope;
Rope won't hang
butcher:
Butcher won't kill ox;
Ox won't drink water;
Water won't quench fire;
Fire won't burn stick;
Stick won't beat dog;
Dog won't bite pig;
Piggy won't get over the stile,
And I sha'n't get home to-night!"

BUT the haymakers said to her, "If you will go to yonder stream, and fetch us a bucket of water, we'll give you the hay." So away the old woman went. But when she got to the stream, she found the bucket was full of holes.

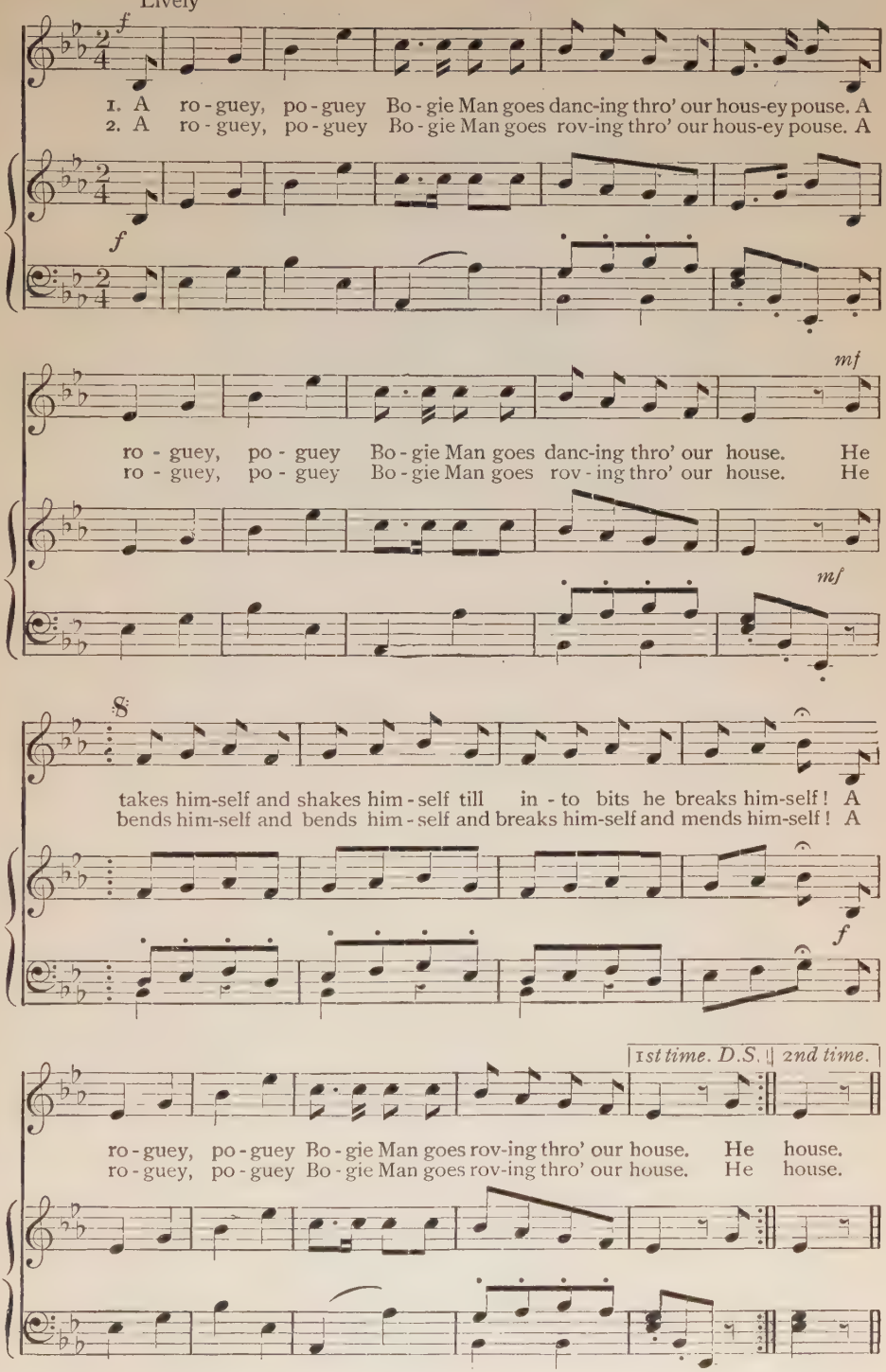
So she covered the bottom with pebbles and then filled the bucket with water, and she went back with it to the haymakers, and they gave her a wisp of hay. As soon as the cow had eaten the hay, she gave the old woman the milk; and away she went with it in a saucer to the cat. As soon as the cat had lapped up the milk:

The cat began to kill the rat;
The rat began to gnaw the rope;
The rope began to hang the butcher;
The butcher began to kill the ox;
The ox began to drink the water;
The water began to quench the fire;
The fire began to burn the stick;
The stick began to beat the dog;
The dog began to bite the pig;
The little pig in a fright jumped over the stile;

SO the old woman got home that night!

THE BOGIE MAN

Words by ALFRED P. GRAVES. Music by permission of MESSRS. SCHOTT & Co.

Lively

f
1. A ro - guey, po - guey Bo - gie Man goes danc-ing thro' our hous-ey pouse. A
2. A ro - guey, po - guey Bo - gie Man goes rov-ing thro' our hous-ey pouse. A
f
mf
ro - guey, po - guey Bo - gie Man goes danc-ing thro' our house. He
ro - guey, po - guey Bo - gie Man goes rov - ing thro' our house. He
mf
8
takes him-self and shakes him - self till in - to bits he breaks him-self! A
bends him-self and bends him - self and breaks him-self and mends him-self! A
f
1st time. D.S. || 2nd time.
ro - guey, po - guey Bo - gie Man goes rov-ing thro' our house. He house.
ro - guey, po - guey Bo - gie Man goes rov-ing thro' our house. He house.

FRENCH—BUYING PRESENTS FOR HOME

First line, French; second line, English word; third line, as we say it in English.

Il pleut. Nous allons acheter des cadeaux pour les emporter chez nous.
It rains. We go to buy some presents for them to take to the house of us.
It is raining. We are going to buy presents to take home.

Nous prenons nos parapluies, et nous sortons. Nous traversons la rue.
We take our umbrellas, and we set out. We traverse the street.
We find our umbrellas, and start out. We cross the street.

Il y a un magasin dans la rue voisine où l'on vend de beaux joujoux.
There is a shop in the street next where the one sells some beautiful toys.
There is a shop in the next street where they sell beautiful toys.

Nous entrons tous. Le commis dit: "Qu'est-ce que madame désire?"
We enter all. The clerk says: "What is this that madam desires?"
We all go inside. The clerk says: "What can I do for you?"

"Nous désirons acheter des cadeaux. Combien coûte cette poupée?"
"We desire to buy some presents. How much costs this doll?"
"We wish to buy some presents. How much is this doll?"

"Quinze francs, madame." "C'est trop. Montrez-moi d'autres poupées."
"Fifteen francs, madam." "That is too much. Show me some other dolls."
"Fifteen francs, madam." "That is too much. Show me some others."

"Puis-je avoir celle-ci avec la robe bleue pour la cousine Elsie?" dit Jeannette.
"May I to have this here with the robe blue for the cousin Elsie?" says Jenny.
"May I have this one in the blue dress for cousin Elsie?" says Jenny.

Nous achetons la poupée, et je choisis des soldats pour mon ami Jean.
We buy the doll, and I choose some soldiers for my friend John.
We buy the doll, and I choose some soldiers for my friend John.

Puis nous choisissons des chaises pour la maison de poupées d'Annette.
Then we choose some chairs for the house of dolls of Annette.
Then we choose some chairs for Annette's dolls' house.

"Il fait du soleil," dit Jeannette. "Allons nous promener."
"It makes of the sun," says Jenny. "Let us go ourselves to promenade."
"The sun is shining," says Jenny. "Let us go for a walk."

THE NEXT FRENCH STORY IS ON PAGE 5754.

THE PRINCE WHO WAS POOR

CONTINUED FROM 5445

THERE was once a poor Prince who had a kingdom. His kingdom was very small, but still quite large enough to marry upon; and he wished to marry.

It was certainly presumptuous of him to ask the Emperor's daughter to marry him. But so he did; for his name was renowned far and wide.

It happened that where the Prince's father lay buried there grew a rose tree—a most beautiful rose tree, which blossomed only once in every five years, and even then bore only one flower, but that *was* a rose! It smelled so sweet that all cares and sorrows were forgotten by him who inhaled its fragrance.

The Prince also had a nightingale which sang as though all the sweet melodies in the world had a dwelling in its little throat. These the Prince prized above all other possessions, and so he placed them in two silver caskets and sent them to the Princess.

The Emperor had them brought into a large hall, where the Princess was playing with the ladies of the court; and when she saw the caskets she clapped her hands for joy.

"Ah, if there were but a little pussy-cat in one of the caskets!" she exclaimed; but just then the rose tree, with its beautiful rose, came to view.

The Princess touched it, and was ready to cry from disappointment; then she pushed it away.

"Let us see what is in the other casket," proposed the Emperor. So the nightingale came forth, and sang so delightfully that at first no one could say anything ill-humored of it. Everyone but the Princess was charmed.

"I hope that it is not a real bird," said the Princess.

"Yes, it is a real bird," said those who had brought it. "Well, then, let the bird fly," returned the Princess; and she positively refused to see the Prince.

However, he was not easily discouraged. He was determined to see her, so he daubed his face with brown and black, pulled his cap over his ears, and knocked at the door.

"Good day to my lord the Emperor," he said. "Can I have employment at the palace?"

"Why, yes," said the Emperor; "I want someone to take care of the pigs, of which we have a great many."

So the Prince was appointed imperial swineherd. He had a dirty little room close by the pigsty, and there he sat the whole day and worked. By the evening he had made a pretty little saucepan. Little bells were hung all round it; and while the pot was boiling these bells tinkled merrily, and played an old melody.

But, what was still more curious, whoever held his finger in the steam

from this saucepan smelled the dishes that were cooking on every hearth in the city.

Now, the Princess happened to walk that way, and when she heard the tune she stood quite still, and seemed pleased, for she could play this old tune—it was the only piece she knew.

"Why, there is my piece," said the Princess; "that swineherd must certainly have been well educated. Ask him the price of the instrument."

So one of the court ladies ran in.

"What will you take for the saucepan?" inquired the lady.

"I will have ten kisses from the Princess," said the swineherd.

"Indeed!" said the lady.

"Well, what does he say?" asked the Princess.

"I cannot tell you," replied the lady; "it is too bad!"

"Then you can whisper it!" So the lady whispered it.

"He is an impudent fellow!" said the Princess, and she walked on. But when she had gone a little way the bells tinkled so prettily that she stopped.

"Ask him if he will have ten kisses from my companions," said she.

"No, thank you!" answered the swineherd; "ten kisses from the Princess, or I keep the saucepan myself."

"That must not be, either," said the Princess; "but do you all stand before me, that no one may see us."

The court ladies placed themselves in front of her, and spread out their dresses, and the swineherd took ten kisses, and the Princess the saucepan.

That was delightful. The saucepan was kept boiling all the evening, and the whole of the following day. They knew perfectly well what was cooking at every fire in the city, from the chamberlain's to the cobbler's. The court ladies danced and clapped their hands.

"We know who has soup and who has pancakes for dinner to-day, who has cutlets and who has eggs. How interesting!" said the court ladies.

The swineherd—that is to say, the Prince, although no one knew that he was other than an ill-favored swineherd—let not a day pass without working at something. At last he constructed a rattle which, when it was swung, played all the waltzes and jig-tunes which had ever been heard.

"Ah, that is wonderful!" said the Princess, when she passed by. "Ask him the price of the instrument."

"A hundred kisses from the Princess," said the young lady when she returned.

"I think he is not in his right senses," replied the Princess, and walked on; she determined not to think about it, but when she had gone a little way she stopped. "We must encourage art," she said. "Tell him he shall have ten kisses from me, and the rest from you."

"Oh, but we should not like that at all!" they said.

"What are you muttering?" asked the Princess. "If I can kiss him, surely you can!"

So the young ladies were obliged to go to him again.

"A hundred kisses from the Princess!" he said.

"Stand around!" said the Princess; and all the ladies stood around while the swineherd kissed the Princess.

"What can be the reason for such a crowd close by the pigsty?" said the Emperor, who happened just then to step out on the balcony. "I must go down to see what they are about!"

When he reached the courtyard he moved very softly, and the ladies were so much engrossed with counting the kisses that they did not see the Emperor.

"What is all this?" he said, when he saw what was going on; and he boxed the Princess's ears, just as the swineherd was taking the eighty-sixth kiss.

"March out!" cried the Emperor, for he was very angry; and both Princess and swineherd were thrust outside the city.

"Alas!" cried the Princess. "If I had but married the handsome young Prince! Ah, how unfortunate I am!"

Then the swineherd went behind a tree on the river bank, where he had hidden his own garments. There he washed the color from his face, threw off his dirty clothes, and when he stepped forth in his princely robes he looked so noble that the Princess could not help but bow before him.

"You are rightly served!" he said. "You would not marry an honorable Prince; you could not prize the rose and the nightingale; but you were ready to kiss the swineherd for the sake of a trumpery plaything!"

And the poor Prince, turning away, went back to his kingdom alone.

THE EMPEROR CAME UP TO THE PIGSTY

As soon as the Emperor reached the courtyard he moved very softly, and the ladies were so engrossed with counting the kisses that they did not see him. "What is all this?" he said, when he saw what was going on.

THE MERRY COBBLER AND HIS COAT

A TALE FROM GRANNY'S WONDERFUL CHAIR

SPARE, the merry cobbler, of whom we read on page 3347, where this tale begins, was treated like a prince at the King's court; and the news of his good fortune reached his brother Scrub in the moorland cottage one first of April, when the cuckoo came again with two golden leaves.

"Think of that!" said Fairfeather. "Here we are spending our lives in this humdrum place, and Spare making his fortune at court with two or three paltry green leaves! What would they say to our golden ones? Let us make our way to the King's palace."

Scrub thought this excellent reasoning. So, putting on their holiday clothes, Fairfeather took her looking-glass and Scrub his drinking-horn, which happened to have a very thin rim of silver, and, each carrying a golden leaf carefully wrapped up that none might see it till they reached the palace, the pair set out in great expectation.

How far Scrub and Fairfeather journeyed I cannot say, but when the sun was high and warm at noon they came into a wood feeling both tired and hungry.

"Let us rest ourselves under this tree," said Fairfeather, "and look at our golden leaves to see if they are quite safe."

In looking at the leaves and talking of their fine prospects, Scrub and Fairfeather did not perceive that a very thin old woman had slipped from behind the tree, with a long staff in her hand and a great wallet by her side.

"Noble lord and lady," she said, "will ye condescend to tell me where I may find some water to mix with a bottle of mead which I carry in my wallet, because it is too strong for me?"

As the old woman spoke she pulled out a large wooden bottle such as shepherds used in ancient times, corked with leaves rolled together, and having a small wooden cup hanging from its handle.

"Perhaps ye will do me the favor to taste," she said. "It is only made of the best honey. I have also cream cheese and a wheaten loaf here, if such honorable persons as you would not think it beneath you to eat the like."

Scrub and Fairfeather became very condescending after this speech. They were now sure that there must be some appearance of nobility about them; besides, they were very hungry, and having hastily wrapped up the golden leaves, they assured the old woman they were not at all proud, notwithstanding the lands and castles they had left behind them in the North Country, and would willingly help to lighten the wallet.

The old woman was a wood-witch; her name was Buttertongue; and all her time was spent in making mead, which, being boiled with curious herbs and spells, had the power of making all who drank it fall asleep and dream with their eyes open. She had two dwarfs of sons; one was named Spy, and the other Pounce. Wherever their mother went they were not far behind; and whoever tasted her mead was sure to be robbed by the dwarfs.

Scrub and Fairfeather sat leaning against the old tree. The cobbler had a lump of cheese in his hand; his wife held fast a hunch of bread. The eyes and mouths of both were open, but they were dreaming of great grandeur at court, when the old woman raised her shrill voice: "What ho, my sons! Come here, and carry home the harvest!"

No sooner had she spoken than the two little dwarfs darted out of the neighboring thicket.

"Idle boys!" cried the mother. "What have you done to-day to help our living?"

"I have been to the city," said Spy, "and could see nothing. These are hard times for us—everybody minds his business so contentedly since that cobbler came. But here is a leathern doublet which his page threw out of the window; it's of no use, but I brought it to let you see I was not idle." And he tossed down Spare's doublet with the merry leaves in it, which he had been carrying like a bundle on his little back.

To explain how Spy came by it, it must be said that the forest was not far from the great city where Spare lived in such high esteem. All things had gone well with the cobbler till the King thought that it was quite unbecoming to see such a worthy man without a servant. His Majesty therefore appointed one of his own pages to wait upon him. The name of this youth was Tinseltoes, and nobody in all the court had grander notions.

TWO DWARFS RAN UP TO THE OLD WITCH

Scrub and Fairfeather sat leaning against the old tree. The cobbler had a lump of cheese in his hand; his wife held fast a bunch of bread. The eyes and mouths of both were open, but they were dreaming of grandeur at court, when the old woman raised her voice, and two dwarfs darted out of the thicket.

Nothing could please him that had not gold or silver about it, and his grandmother feared he would hang himself for being appointed page to a cobbler. As for Spare, the honest man had been so used to serve himself that the page would have been always in the way, but his merry leaves came to his assistance.

Tinseltoes took wonderfully to the new service. Some said it was because Spare gave him nothing to do but play at bowls all day on the palace green. Yet one thing grieved the heart of Tinseltoes, and that was his master's leathern doublet, and at last, finding nothing else would do, the page got up one fine morning earlier than his master, and tossed the leathern doublet out of the window into a lane, where Spy found it.

"That nasty thing!" said the old woman. "Where is the good in it?"

By this time Pounce had taken everything of value from Scrub and Fairfeather —the looking-glass, the silver-rimmed horn, the husband's scarlet coat, the wife's gay mantle, and, above all, the golden leaves, which so rejoiced old Buttertongue and her sons that they threw the leathern doublet over the sleeping cobbler for a jest, and went off to their hut in the heart of the forest.

The sun was going down when Scrub and Fairfeather awoke from dreaming that they had been made a lord and a lady, and sat clothed in silk and velvet, feasting with the King in his palace hall. It was a great disappointment to find their golden leaves and all their best things gone. Scrub tore his hair, and vowed to take the old woman's life; while Fairfeather lamented sore. But Scrub, feeling cold for want of his coat, put on the leathern doublet without asking whence it came.

Scarcely was it buttoned on when a change came over him. He addressed such merry discourse to Fairfeather that, instead of lamenting, she made the wood ring with laughter. Both busied themselves in setting up a hut of boughs, in which Scrub kindled a fire with a flint of steel, which, together with his pipe, he had brought unknown to Fairfeather, who had told him the like was never heard of at court. Then they found a pheasant's nest at the root of an old oak, made a meal of roasted eggs, and went to sleep on a heap of long green grass which they had gathered, with nightingales singing all night long in the old trees about them.

In the meantime Spare had got up and missed his doublet. Tinseltoes, of course, said he knew nothing about it. The whole palace was searched, and every servant questioned, till all the court wondered why such a fuss was made about an old leathern doublet. That very day things came back to their old fashion. Quarrels began among the lords, and jealousies among the ladies. The King said his subjects did not pay him half enough taxes, the Queen wanted more jewels, the servants took to their old bickerings and got up some new ones. Spare found himself getting wonderfully dull and very much out of place, and the nobles began to ask what business a cobbler had at the King's table. At last his Majesty issued a decree banishing the cobbler forever from court, and confiscating all his goods in favor of Tinseltoes.

The royal edict was scarcely published before the page was in full possession of Spare's rich chamber, his costly garments and all the presents the courtiers had given him; while Spare was glad to make his escape out of the back window, for fear of the angry people.

The window from which Spare let himself down with a strong rope was that from which Tinseltoes had tossed the doublet, and as the cobbler came down late in the twilight, a poor woodman, with a heavy load of fagots, stopped and stared in astonishment.

"What's the matter, friend?" said Spare. "Did you never see a man coming down from a back window before?"

"Why," said the woodman, "the last morning I passed here a leathern doublet came out of that window, and I'll be bound you are the owner of it."

"That I am, friend," said the cobbler with great eagerness. "Can you tell me which way that doublet went?"

"As I walked on," the woodman said, "a dwarf called Spy bundled it up and ran off into the forest."

Determined to find his doublet, Spare went on his way, and was soon among the tall trees; but neither hut nor dwarf could he see. At last, when he was on the point of giving up, the red light of a fire, gleaming through a thicket, led him to the door of a low hut. It stood half open, as if there was nothing to fear, and within he saw his brother Scrub snoring

loudly on a bed of grass, at the foot of which lay his own beloved leathern doublet; while Fairfeather, in a scarlet kirtle, sat roasting pheasants' eggs by the fire.

"Good evening, mistress!" said Spare.

The blaze shone on him, but so changed was her brother-in-law with his court life that Fairfeather did not know him, and she answered far more courteously than was her wont.

"Good evening, master! Whence come ye so late? But speak low, for my good man has sorely tired himself cleaving wood, and is taking a sleep, as you see, before supper."

"A good rest to him," said Spare, perceiving he was not known to her, "I come from the court for a day's hunting, and have lost my way in the forest."

"Sit down and have a share of our supper," said Fairfeather; "I will put some more eggs in the ashes; and while they are roasting tell me the news of court."

"Did you never go there?" said the cobbler. "So fair a dame as you would make the ladies marvel."

"You are pleased to flatter," said Fairfeather; "but my husband has a brother there, and we left our moorland village to try our fortune also. An old woman enticed us with fair words and strong drink at the entrance of this forest, where we fell asleep and dreamed of great things; but when we woke everything had been taken from us, and in place of everything the robbers left him that old leathern doublet, which he has worn ever since, and never was so merry in all his life, though we live in this poor hut without any possessions."

The astonished woodman stared at Spare.

"It is a shabby doublet, though," said Spare, taking up the garment, and seeing that it was his own, for the merry leaves were still sewed in its lining. "It would be good for hunting in, however. Your husband would be glad to part with it, I dare say, in exchange for this handsome cloak." And he pulled off the green mantle and buttoned on the doublet, much to Fairfeather's delight, for she shook Scrub, crying: "Husband, husband, rise and see what a good bargain I have made!"

Scrub rubbed his eyes, gazed up at his brother and said: "Spare, is that really you? How did you like the court, and have you made your fortune?"

"That I have, brother," said Spare, "in getting back my own good leathern doublet. Come, let us eat eggs, and rest ourselves here this

night. In the morning we will return to our own old hut, at the end of the moorland village, where the Christmas cuckoo will come and bring us leaves every year as before. That will be better than courts."

Scrub and Fairfeather agreed. So in the morning they returned, and found the old hut little the worse for wear and weather. The neighbors came about them to ask the news of court and to see if they had made their fortune. Everybody was astonished to find the three poorer than ever, but somehow they liked to be back in the hut. Spare brought out the lasts and awls he had hidden in a corner; Scrub and he began their old trade, and the whole North Country found out that there never were such cobblers. Everybody wondered why the brothers had not been more appreciated before they went away to the court of the King, but, from the highest to the lowest, all were glad to have Spare and Scrub back again.

They mended the shoes of lords and ladies as well as the common people; everybody was satisfied. Their custom increased from day to day, and all that were disappointed, discontented or unlucky came to the hut as in old times, before Spare went to court.

The hut itself changed, no one knew how. Flowering honeysuckle grew over its roof; red and white roses grew thick about its door. Moreover, the Christmas cuckoo always came on the first of April, bringing three leaves of the merry tree—for Scrub and Fairfeather would have no more golden ones. So it was with them when I last heard the news of the North Country.

SPARE PULLED OFF THE GREEN MANTLE AND BUTTONED ON THE OLD LEATHERN DOUBLET

Meanwhile at the court matters went from bad to worse. The King and Queen quarreled daily, with each other, with the courtiers and with the servants. Tinseltoes became so conceited that the King chased him away from the palace. The taxes went up until the people groaned under the burden. Indeed, it was a very trying time. Everyone sighed for the good old peaceful days. Yet it is strange that no one realized that all the evils followed the expulsion of Spare the cobbler, and they never learned the truth.

LEGENDS OF PLACES AND THINGS

KING WREN

WHEN all the birds came together to choose their king, there was much dispute as to the manner of choosing.

"Beauty is what we want in a king," said the peacock. "Let us show off our feathers."

"No, we need dignity," said the owl. "Let us see who is the wisest looking."

"Or who can talk the best," said the parrot.

But the eagle exclaimed: "What raises us above all other creatures? The power of flying. We must choose as a king the bird that flies the highest."

And as the eagle was strong and fierce, he compelled the assembly to agree to this test. At a signal the birds rose up and tried to outfly each other, but the eagle soon soared above them all, and went up to an amazing height until his strength was exhausted. Then a wren, who had been perching on his back, flew a little higher than the eagle had gone. So, to the great disgust of the eagle, the little wren became king.

POET, GOBLIN AND DONKEY

FAIRIES have more powers of magic than witches, and great poets have more powers of magic than fairies. Great poets can raise up mighty nations with their enchantments, and people the waste places with shining spirits. Thomas the Rhymer was one of the last of these great poets. He could sing a man's soul out of his body and send it whither he willed.

One day the youngest daughter of the Queen of Scotland fell ill, and the Queen sent Thomas the Rhymer to get some magic ointment from the goblin hiding in the heart of Ailsa Craig.

Thomas the Rhymer came to Ailsa Craig and began to chant strange chants there. He chanted the head of the goblin out of the great rock; he chanted its shoulders out. But just as he was chanting out its hand holding the magic ointment, a donkey brayed and spoiled his chant, and frightened the goblin clean out of the rock, and the goblin escaped with the magic ointment.

So it has happened ever since. Some donkey always begins to bray when a great poet begins to sing. That is why no great poet nowadays can work such marvelous enchantments as Thomas the Rhymer worked before he went to Ailsa Craig.

THE GIANT OF THE PEAK

KITTY GREEN was a little girl who lived in the Peak district, and one Sunday, instead of going to church, she went for a walk. And she walked until she came to an enchanted mountain, which made everybody who trod on it fall asleep. So Kitty fell asleep, and the giant of the Peak found her and carried her to his castle, and made her his servant.

After Kitty had cleaned his enormous boots, he said: "Come and hold my golden ring and ball while I bathe, and mind you don't let the ball fall into the ring."

Kitty took them, but just as she was wishing she was back at home she let the ball slip into the ring, and she at once found herself at home with her father and mother. Then, every time that she wished for anything she only had to put the ball in the ring and her wish was at once granted. So she became very rich and happy.

THE BROWNIE OF SNAEFELL

BROWNIES are different from fairies. They are little clumsy goblins with hairy legs, and they are good-natured, but rather stupid. A farmer in the Isle of Man befriended a brownie, and the brownie offered to bring down the farmer's sheep from Snaefell mountain.

"Whoo!" he said, when he returned late at night. "That little ram of yours was a trouble. I had to chase him three times round Snaefell before he would come with the other sheep."

"My little ram?" said the farmer. "I haven't one."

He looked at the sheep, and among them he saw a poor, tired hare! Now, could you fancy a fairy mistaking a hare for a sheep?

THE LARK AND HER YOUNG ONES

A LARK once had a nest of young birds in a cornfield and one morning as she went out to seek food for them she told the little larks to listen carefully to anything they might hear the farmer say, and to tell her when she came back.

On her return they said that the farmer had been there with his son, and had arranged to ask his neighbors to come the next day and help him to reap the corn.

"Then," said the old bird, "there is no danger yet."

Next day the young larks told their mother that the farmer had been there again, and had told his son to ask his cousins to come and help to reap the corn. The old lark still said that there was no danger yet.

On the third day the young birds told their mother how the farmer had said

that next morning he would reap the corn himself.

"Then," answered the mother lark, "it is time that we went somewhere else. The farmer's neighbors and friends were not very likely to come and help him; but if he is going to reap the corn himself we must move our home to another field."

If you want a thing done, do it yourself.

THE FOX AND THE WOLF

A FOX had the misfortune to fall into a well, where he was in danger of drowning. He cried out for help, and a wolf happened to hear him and came running up to see what was the matter.

"Oh, Mr. Wolf," cried the fox, "pray lend me a hand and help me out or I shall be drowned!"

"Poor creature!" cried the wolf. "How sorry I am to see you in such a fix! How long have you been here? However did it happen? The water must feel very cold. Is it very deep?"

"Come, come! This is no time for talking," said the fox. "Help me out of

the water first, and then I will tell you all about it."

Don't stand talking when there is work to be done.

THE DONKEY'S WISH

ONE cold winter's day a discontented donkey was wishing for a little warm weather and some fresh grass, instead of the cold shed in which he stood and the dry straw that he had to eat.

By and by the warm spring weather came and the fresh grass with it; but the donkey had now so much work to do that he soon grew tired of the spring and longed for the summer. When summer came he found himself still worse off, for he had to carry hay and vegetables.

So he wished for the autumn to come; but when it arrived he had to work hard and carry grain, apples, fuel, provisions for the winter, and so on; until at last he

began to long for winter, when, at any rate, he would be able to rest, even if he did not have much to eat.

Try to be contented with what you have. Remember that you might be much worse off than you are.

THE NEXT STORIES ARE ON PAGE 5683.

At the bottom of the sea.

LIFE IN THE WATERS

WE have traveled far together in pursuit of knowledge of mammal, bird or reptile. Now we have come to the brink of the waters to survey the things that, whatever their way in after-life, must obey the summons of Nature to lay their eggs in moist places.

We have explored mountain and valley, jungle and marsh; now we embark on the deeps, the water. We have considered every known class of land animals, yet have described the residents of only two-sevenths of the area of the world. Five-sevenths of the world remain, all under water. There is life in every drop of this vast world of sea and ocean, river and lake.

The oceans are constantly evaporating and pouring their rivers of vapor into the air. They descend as rain, snow and hail, to fill lakes and rivers, which carry back to the seas many millions of cubic miles of water every year. The streaming oceans give the dew of life to the land, quench our thirst, sustain plant and animal, and support within their depths the greatest of all assemblages of known life.

In no place are more astounding wonders found than in the waters. It is a realm where surpassing beauty contrasts with grim hideousness, a place of idyllic existence in sunny seas by golden sands and fairy caves, balanced by dark deeds perpetrated in unsunned abysses; of lovely colors worn by fish and shell, of light that springs from the bodies of animals, of fishes with eyes like gleaming lamps, of other fishes that are blind.

Nowhere do we find contrasts more startling. Here a single drop of water is the entire world of many animalcules. One of them would be desolate, lost at sea, if left alone in a globule of moisture—so unthinkably tiny is it. In such a speck of water there may be more living creatures than there are people in this whole country.

The tiniest things that have life are in the waters, and so are the greatest. At the one extreme are these microscopic perfections, uncountable in their profusion. At the opposite extreme is the whale, a hundred feet long and weighing two hundred tons. We must stand at a height to realize the immensity of a whale; we must peer through the microscope to grasp the small proportions of the others.

But how important is the tiny thing! We talk of Emerson's little poem about the mountain and the squirrel, and the retort of the merry little fellow that if he could not carry mountains on his back, neither could the moun-

tain crack a nut; and we say to ourselves that the animalcules can make mountains as well as perky squirrels crack their nuts. Yes, limestone, chalk, marble and many other rocks were all alive once. Diatoms, radiolaria, foraminifera grow patterned shells of silica or carbonate of lime. They live and die in billions, and their little shells, welded by time and tide, have been raised so high during the centuries that mountain ranges have been formed from their remains.

If Time could run backward, we might see such marble statues as the Venus of Milo, the Laocoön, Michelangelo's David, and the lost works of Phidias dissolve into life and rearrange themselves into myriads of living specks from the water within shells exquisitely carved by the chisel of Nature.

All kinds of life are in the waters. There are tiny specks of living jelly, mere pulsing mites of living matter. They reach maturity in less than an hour, then divide in halves, so that one becomes two, two become four, four become eight, and so on, until at the end of twenty-four hours, one may have multiplied into a million.

THE ASTONISHING WAY IN WHICH A LIFE GOES ON AND ON

That is an example always cited as a sort of immortality, the same life extending and ranging on in this amazing way, age after age. Of course, death comes every hour to billions of these amebas, as they are called, or in a few weeks all the waters would be solid with them. Everything is food for something else, from diatom to dolphin, and each type has some part to play. Such things as diatoms are believed to have an important business in creating oxygen for the waters, as do the water weeds which we put for the same purpose into an aquarium.

These lesser forms, the diatoms, the animalcules, with swarms and swarms of eggs and minute fish and crustaceans, make up the diet of larger forms. In turn the larger forms are food for herrings, mackerel, salmon and—whales.

The sea has its rhythms, not yet explained. We know that sunlight brings a great increase of the lowlier types, so that they color the waters for hundreds of miles. For instance, they give the Red Sea its name, from the color they bestow on it in their seasons of abundance. And as this food supply rises, so the food supply of the greater fish is enriched. If fish hatch out when the supply is absent, they die. So sunshine promotes health and harvests not only ashore but in the ocean.

MYRIADS OF SMALL CREATURES MAKE THE SEA LIKE MOLTEN SILVER

Great variety and beauty of pattern mark the shells of the animalcules, but that is not the chief wonder. Some of them glow at night with phosphorescent light. We have luminous glow-worms, fireflies, centipedes and other brilliant insects on land, but we have nothing like the *noctilucæ* of the sea. They abound in such myriads that sometimes at night, as a ship's prow cuts the waters, the sea seems to catch fire and the ship seems to move on molten silver. The unthinkable swarms of these little animals, thickly clustered in every inch of sea, have kindled their glowing torches, that is all.

They are not the only ones which have this gift. Down in the gloom, weird fishes, with stomachs like great nets that inclose victims actually larger than themselves, and with teeth like rakes of bone, have also this wondrous light. They light their head-lamps in the dark. Whether they do this to see other fishes or to lure other fishes to their terrible jaws we know not. But they do it, and there is an octopus in tropical waters which has a glow-lamp like an electric torch. By it we can see the fantastic horrors of this monster, clawed like a tiger.

We have glanced at the importance of the diatoms in adding oxygen to the sea. Water creatures, though generally they breathe in a way different from mammals, must have oxygen.

NATURE'S CLEVER DEVICE FOR HELPING THE FISHES IN THE WATER

Man can obtain oxygen from water, but only by an elaborate and costly process. Water creatures take it out of the water and pass it into their bodies as easily as we inhale it. The more active and ambitious the form, the more its demands for this vital principle of life. The presence of this swim-bladder is an index to the life the creature leads.

The flat fishes lying on the oozy bed of the sea have no such organ, but fishes which make great journeys at high speed usually carry this aid to efficiency. This swim-bladder possibly serves a double purpose. In part it may be Nature's

way of regulating the depth of its possessor in the sea. In part it is a reservoir for the source of energy.

The air-bladder, as it is commonly named, does not contain ordinary air, but mainly oxygen mixed with slight traces of carbon and nitrogen. This reserve store of oxygen can be drawn on instantly if need arises for some great muscular effort, such as catching prey or escaping capture. Associated with this method of storage is another curious one, the dark coloration of the flesh.

The dark color of the salmon, mackerel and tunny is simply stored energy made visible. These fishes are tremendously powerful swimmers, speedy, far-voyaging, enduring. The color we see in their flesh is hemoglobin stored in the muscle, ready to be changed into energy at need.

But it will be objected that not all fish keep to the water, and that is so. There are certain fish which have lungs as well as gills. The mudfish, for example, coils itself up in a ball within a clod of mud and sleeps away the season when its native river is dry. In that clod it can be carried unharmed round the world.

THE FISH THAT PACKS UP MOISTURE AND GOES ON LAND

Some catfish can store up air in a wonderful way; the climbing perches, which leave their ponds and climb trees, have a complex form of gills in which they can seal enough oxygen-giving moisture to furnish them for their land travels. And there are fishes of the goby tribe which can skip about the mud with their whole bodies exposed to the air, except the tail, which must remain immersed or moistened to permit its owner to continue alive.

It is an interesting question how color came into the life of the waters, and what its purpose is. The average fish is perfect in grace and outline, in silvery mail, in grace of movement. We cannot understand why sea gardens should be lovely with vegetation, why coral islands and reefs should be like little dream cities of exquisite hue, set beneath the sea. We cannot imagine the purpose of the colors with which the cowry is lavishly endowed. There is not one more exquisite on any canvas by an Old Master than those which adorn the soft repulsive body of these sluggish creatures in shells; yet the gift is, so far as we can see, entirely wasted in the dark waters, hidden by the animal's own structure.

THE RAINBOW FISH THAT LURES ITS ENEMY TO DESTRUCTION

Superb colors adorn many of the fish, and here we do get a clue to purpose. Those most highly colored are generally unfit for human food. In some cases we find that the dazzling beauty is a decoy fish, which, when pursued, darts into the interior of a massive sea-anemone, followed by its foe. The little rainbow fish is unharmed in that gloomy fleshy cavern, but the fish which pursues it is paralyzed and digested by its host. The handsome lure remains inside while digestion takes place, but afterward escapes.

That is an outstanding example of co-operation, and the waters teem with them. The hungry shark has its guide, or companion, in the little pilot fish which precedes or follows it, as the hyena precedes or follows the lion. The hermit crab, housing itself in a discarded shell, enjoys a partnership with a sea-anemone, which it carries about with it, at once a mask and a bait. The oyster is sought by a parasite, and covers the parasite with nacre, the marvelous fluid which hardens into the pearl.

Of the modest European river mussel there is a still stranger tale to tell. The pearl is a tomb: the mussel is a nursery. A little fish called the bitterling seeks out the open shell of the mussel and drops eggs there. In the folds of the mussel's mantle the eggs hatch into fishes. The shellfish carries the load for a month or more, when the intruding infants escape into the water.

HOW THE MUSSEL AND THE BITTERLING IMPOSE ON EACH OTHER

But the mussel puts her little ones out to nurse with the bitterling. These cling to the tiny fish. As they grow they cause an irritation on the skin of the fish, so that abnormal growth is promoted and the skin grows over the mussel. So housed, the baby mussel goes riding to and fro, part of the body of its host. At the proper time it leaves its living home and drops into the water. There it settles down with millions of other mussels, spins a cable of silk, and anchors itself securely to stones or piles. Engineers sometimes throw thousands of mussels on the masonry of a breakwater, knowing that the mussels will bind the blocks more securely than cement.

We have animals which, falling short of true flight, have reached the parachute stage. So in the midst of the sea we have fish, not unlike slim greyhound herrings, which, with the water as a springboard, leap into the air and fly 150 feet at a time. Their fins are greatly lengthened for the purpose, so they must have been air-skimming for ages. These flights of the flying fishes are probably often the outcome of sheer delight and play. But danger must have been the primary impulse out of which these extraordinary excursions in the air were begun by the flying fish. Life in the waters is one unending round of danger. Nearly all fishes are flesh-eaters, and therefore their life depends on their killing other creatures.

Now, as we have often had an opportunity of seeing, Nature takes notice of the perils to which her children are exposed. The greater the danger, the more Nature drives a species to seek to multiply. And nowhere do we see such enormous outputs of potential life as in the waters.

How Nature Adjusts the Balance of Life in the Waters

In some cases it would seem as if no number of eggs, however great, sufficed to overcome the prospect of extinction. In such conditions Nature has decreed that the mother fish shall not lay her eggs broadcast, but shall retain them in her body so that they may safely hatch there. Sharks are born alive, powerful young cruisers from the instant of birth; and some of the rays, certain surf-haunting perches, do the same. There are other fishes that incubate their own eggs.

The rule on land is that animals which produce their young alive, or incubate their eggs, are responsible for only a small number. The totals in the water are enormous, even for those in which the eggs are not put forth. A blenny may give birth to more than two hundred young ones at a time. The great shark, with fewer foes to fear and all the sea animals to feed on, produces but a few young at a time.

In the majority of cases fishes lay eggs, and for the most part trust to chance to bring them to maturity. Of course they do not all reach the desired goal; if they did, navigation by man would become impossible in a single summer. When salmon are running in great numbers up certain American rivers, instances are on record where steamers have been brought to a standstill by the press of fish, their propellers unable to move.

The Oyster That May Lay Sixty Million Eggs in a Year

That would be the case in every sea and every river if the life spread on them every year were not as a banquet for the consumption of all comers. For a mother salmon lays a thousand eggs for every pound of her weight, and she may weigh fifty pounds. The eel will lay perhaps ten million eggs. The European ling is a veritable miracle in the number of its eggs; over 28 millions have been found in the body of a ling weighing 54 pounds. A turbot has been known to have nine million eggs, a cod quite as many. The hard roe in a herring may contain 50,000 eggs. The oyster, which becomes an adult in three years, is said to be capable of laying 60 million eggs a year.

Now, all that Nature demands from a single pair of parents, no matter to what order they belong, is that they shall, at the end of their lives, leave two of their kind to take their places. It is because of the risk of this not happening, of a species being slowly driven to extinction, that this enormous fruitfulness is necessary. If the method changed; if it became safe for all sorts of fish to produce only one or two young, or as few eggs as birds do, life as a whole in the waters would vanish. The eggs and larvæ of all sorts of marine creatures are the natural food of other species of fish; the eggs and tiny baby fish and crustacea for the smaller tribes, the smaller tribes themselves for the greater fish and other animals, right on through the whole scale until we find the island-like sperm whale living almost entirely on enormous sea squids.

The Impulse and Guiding Force of the Creatures in the Deeps

There is room for all species and for unthinkable populations of all species. It is numbers, not intellect, which count here. Instinct is the impulse and the guiding force of the creatures whose way is in the midst of the waters. The realm of the deeps abounds in fascination, wonder, charm and horror, but the qualities which made the mammals supreme are not there.

THE NEXT STORY OF ANIMAL LIFE IS ON PAGE 5629.

JOHN BUNYAN'S GREATEST WORK

NO book, except the Bible itself, has had greater influence for good on the minds of men than The Pilgrim's Progress. Written in simple, straightforward English, by a poor tinker who became a powerful preacher of God's message to mankind, this immortal story is likely to be read as long as our literature endures. The story is told as an allegory, illustrating the trials that beset a Christian on his way through life. But it is better than most allegories, because the characters are so human. We are instantly interested in each for his own sake, as well as anxious to know what happened to them all. John Bunyan, the author, was born at Elstow, near Bedford, in 1628, and died in London in 1688. He was imprisoned for twelve years for daring to preach the Gospel without the sanction of the Church. While in Bedford prison he wrote the first part of his immortal story, which is here retold largely in his own words.

THE PILGRIM'S PROGRESS

AS I walked through the wilderness of this world I lighted on a certain place where was a Den, and I laid me down in that place to sleep, and as I slept I dreamed a dream.

I dreamed, and behold I saw a man clothed in rags, standing in a certain place, with his face from his own house, a book in his hand, and a great burden upon his back. I looked, and saw him open the book and read therein; and as he read he wept and trembled, and at length brake out with a lamentable cry: "What shall I do?"

In this plight he went home and told his wife that he was informed that their city would be burnt with fire from heaven, in which fearful overthrow he and his wife, and his sweet babes would miserably come to ruin, except some way of escape could be found. His relations tried, without avail, to rid him of his fears.

Now, I saw upon a time when Christian—for this was the man's name—was walking in the fields that he was reading in his book; and as he read he burst out as before, crying: "What shall I do to be saved?" I looked then and saw a man named Evangelist coming to him, who asked: "Wherefore dost thou cry?"

When he had answered, Evangelist said: "If this be thy condition, why standest thou still?"

"Because I know not whither to go," he answered.

Then Evangelist gave him a parchment roll, and there was written thereon: "Flee from the wrath to come." The man read it, and, looking upon Evangelist carefully, said: "Whither must I fly?"

Then said Evangelist, pointing with his finger over a very wide field: "Do you see yonder wicket-gate?" The man said: "No." Then said the other: "Do you see yonder shining light?" He said: "I think I do." Then said Evangelist: "Keep that light in your eye and go up directly thereto, so shalt thou see the gate, at which, when thou knockest, it shall be told thee what thou shalt do."

So I saw in my dream that the man began to run. Now, he had not run far from his own door, but his wife and children and neighbors, perceiving it, cried out to him to return. But the man ran towards the middle of the plain.

Two of his neighbors, Obstinate and Pliable, resolved to fetch him back by force. When they came up with him, he told them that if they died in the City of Destruction, where he and they were born, they would sink lower than the grave.

They talked together, and Christian asked them to read in his book.

"I saw a man clothed with rags, a book in his hand, and a burden on his back. As he read he wept and trembled, saying, 'What shall I do?'"

Obstinate cried: "Away with your book! Will you go back with us or no?"

"No, not I," said Christian, "because I have laid my hand to the plough."

Obstinate then went back, but Pliable offered to go with Christian, and even urged him to mend his pace, when he heard further what the things were and how to be enjoyed whither they were going. But Christian had a burden on his back, and Pliable was unencumbered.

Now, I saw in my dream that, just as they had ended this talk, they drew very near to a very miry slough, and, being heedless, they did both fall suddenly into the bog. The name of the slough was Despond. And Christian, because of the burden that was on his back, began to sink in the mire. Then said Pliable: "Ah, neighbor Christian, where are you now?"

"Truly," said Christian, "I do not know."

At this Pliable began to be offended, and angrily said to his fellow: "Is this the happiness of which you have told me all this while? May I get out again with my life, you shall possess your brave country alone for me." And with that he gave a desperate struggle and got out of the mire on that side of the slough which was next to his own house, and Christian saw him no more.

Christian, left to tumble in the Slough of Despond alone, endeavored to struggle to that side that was next to the wicket-gate; which he did, but could not get out, because of the burden that was upon his back. But I beheld in my dream that a man came to him whose name was Hope, and set him upon sound ground.

Now, as Christian was walking along by himself, he was met by Mr. Worldly Wiseman, who advised him that he could get rid of his burden much more easily by applying to one Legality, whose

Pliable, who became afraid, and deserted Christian.

house was on a high hill which he pointed out. So Christian turned out of his way to go to Mr. Legality's house for help, but when he got hard by the hill it seemed so high, and that side of it which was next the wayside did hang so much over, that Christian was afraid to venture further. His burden seemed heavier, and flashes of fire came out of the hill that made Christian afraid that he should be burnt.

In this way he was found by Evangelist, and once more set on the right path; and so in process of time he got up to the wicket-gate. The gate was opened to him by Goodwill, who, after hearing his story, asked him to look before him at a narrow way.

"That," said Goodwill, "is the way thou must go."

"But," said Christian, "are there no turnings or windings, by which a stranger may lose his way?" "Yes," said the other, "there are many ways butt down on this, and they are crooked and wide. But thus thou mayest know the right from the wrong, the right only being straight and narrow."

Early in the journey they fell into the Slough of Despond. Pliable got out on the side nearest home, but Christian struggled to the other side.

Obstinate, who tried to bring Christian back.

Then Christian went on till he came to the house of the Interpreter. After he had knocked, as he had been told to do by Goodwill, and the door had been opened, I saw in my dream that the Interpreter took him by the hand, and, leading him within, showed him a picture of the man whom the Lord of the place whither he was going had authorized to be his guide, and other excellent things such as would be a help to him in his journey. When the Interpreter had given him his blessing, Christian went on his way, pondering on the things that had been shown to him.

Now, I saw that the highway up which he had to go was fenced on either side with a wall, called Salvation. Up this way, therefore, did burdened Christian

Christian had much profitable discourse in the Palace Beautiful.

So I saw in my dream, just as Christian came up with the cross, his burden loosed from off his shoulders, and fell from off his back, and began to tumble, and so continued to do till it came to the mouth of the sepulchre, when it fell in, and I saw it no more.

Then was Christian glad and lightsome, and stood a while to look and wonder, till the springs that were in his head sent the water down his cheeks. As he stood looking and weeping for gladness, behold three Shining Ones came to him and saluted him with: "Peace be to thee." The first said to him: "Thy sins be forgiven thee"; the second stripped him of his rags, and clothed him with change of raiment; the third also set a mark on his forehead, and gave him a roll with a seal upon it, bidding him look on it as he ran, and that he should give it in at the Celestial Gate. So they went their way, and Christian gave three leaps for joy and went on singing.

run, but not without great difficulty, because of the load on his back. He ran till he came at a place somewhat ascending, and upon that place stood a cross, and a little below, in the bottom, a sepulchre.

CHRISTIAN'S FIGHT WITH APOLLYON

WHILE resting on the hill called Difficulty, Christian fell into a deep sleep. And as he slept his roll dropped from his hand. At the summit of the hill he met two men, named Timorous and Mistrust. They said they were returning, because the farther they went the more dangers they met with.

This caused Christian to feel in his bosom for his roll, that he might read therein and be comforted. But, finding it not, he went down the hill again to the arbor, where he had slept. Who can tell how joyful this man was when he had gotten his roll again, which was to be his pass into the Celestial City? How nimbly did he now go up the hill! But before he got up, the sun went down upon him, and he thought of the lions in the way, of which Timorous and Mistrust had told him. But while he was blaming himself for sleeping, he lifted up his eyes and saw before him a stately palace, the name of which was Beautiful. So he made haste that, if possible, he might get lodging there.

Before he had gone far he entered a very narrow passage, about a furlong off the porter's lodge, and espied two lions in the way. The lions were chained, but he saw not the chains, and was afraid. But the porter, whose name was Watchful, called out to him to keep in the midst of the path, if his faith was strong enough. This Christian did, and so entered the Palace Beautiful, which was built for the relief and security of pilgrims.

There came forth to meet him a beautiful damsel called Discretion, who, on learning his story, called out Piety, Prudence and Charity. Thus was Christian welcomed into the house.

Here he had much profitable discourse, such as he had had at the Interpreter's house. After supper, Christian was given a large upper chamber, whose window opened toward the sun-rising, and here he slept till the break of day.

Before he left this place, the rarities of which were shown to him, he was taken up on to the roof, whence he beheld at a great distance a most pleasant mountainous country. The mountains were the Delectable Mountains, and the country was Emmanuel's Land, from which he was told he could see the gate of the Celestial City.

Christian was now anxious to be setting forward, but before letting him go his hosts took him into the armory, where they harnessed him from head to foot, except upon his back, with what was proof against attack, lest perhaps he should meet with assaults on the way. At the gate he learnt from the porter that one Faithful, a fellow-townsman, had passed that way.

TIMOROUS

MISTRUST

On the Hill Difficulty, Christian met Timorous and Mistrust, who were coming back because the dangers that lay ahead made them lose heart.

Then he began to go forward, but Discretion, Piety, Charity and Prudence accompanied him to the foot of the hill, which led to the Valley of Humiliation. Christian went down very warily, for the hill was dangerous, yet he had a slip or two. When all were at the foot of the hill, his good companions gave Christian a loaf of bread, a bottle of wine, and a cluster of raisins; and then he went on his way. But poor Christian had gone only a little way in the valley before he espied a foul fiend, hideous to behold, coming to meet him.

The name of the fiend was Apollyon. Christian was at first afraid, and began to cast in his mind whether to go back or stand his ground. But as he had no armor on his back, he thought that to turn might give the enemy the greater advantage to pierce him with his darts. So he went on, and Apollyon, when he refused to go back, straddled quite over the way, and hurled a flaming dart at Christian's breast. Thus began a sore combat that lasted for over half a day.

When Christian had been wounded in head, hand and foot, and was almost spent, Apollyon came to close quarters, and, wrestling with him, gave him a dreadful fall, so that his sword flew out of his hand. Then said Apollyon: "I am sure of thee now." And with that he almost pressed him to death. But while Apollyon was fetching of his last blow, Christian nimbly stretched out his hand and, regaining his sword, gave the fiend such a thrust that he spread his dragon's wings, and sped him away. Then there came to Christian a hand with some of the leaves of the Tree of Life, which Christian took, and applied to the wounds which he had received, and was healed immediately. He also sat down in that place to eat bread, and to drink of the bottle that was given him a little before; so being refreshed, he addressed himself to his journey. Apollyon did not appear again.

Christian carried his drawn sword in his hand this time, fearing some other enemy, but he met with no other affront in this valley.

THE PILGRIMS IN VANITY FAIR

NOW, at the end of the Valley of Humiliation was another, called the Valley of the Shadow of Death. And Christian must needs go through it, because the way to the Celestial City lay through the midst of it. The pathway was extremely narrow. On the right hand was a very deep ditch. On the left hand was a very dangerous quag. Besides, the darkness was so great that Christian could hardly tell where, or on what, in going forward he should next set his foot.

About the midst of this valley, and near the wayside, was the mouth of the Underworld. Ever and anon flame and smoke would come forth with hideous noises. Christian heard doleful voices, and fiends came towards him. Near the burning pit one of the fiends came up softly to him, and whisperingly suggested many bad thoughts to him, which he verily believed had proceeded from his own mind.

When Christian had traveled in this disconsolate condition some considerable time, he thought he heard the voice of a man, as going before him, saying: "Though I walk through the Valley of the Shadow of Death, I will fear no evil, for Thou art with me." Then he was glad, because he gathered that some who feared God were in this valley as well as himself. Then the day broke, and Christian said: "He hath turned the shadow of death into the morning."

This was another mercy to Christian, for, from the place where he now stood to the end of the valley, the way was all along set full of snares, nets, and pitfalls. In this light, therefore, he came to the end of the valley.

Now, as Christian went on his way he came to a little ascent, which was cast up on purpose that pilgrims might see before them. Up there Christian, looking forward, saw before him Faithful, his fellow-townsman, of whom he had heard from the porter at the Palace Beautiful. Then said Christian aloud: "Ho, ho, soho! stay, and I will be thy companion!"

Then I saw in my dream that they went very lovingly on together, and had sweet discourse of all the things that had befallen them in their pilgrimage, and of what had happened in the City of Destruction after Christian had left.

When they were got out of the wilderness, they presently saw a town before them, and the name of that town is Vanity. And at the town there is a fair kept, called Vanity Fair; it is kept all the year long. Almost five thousand years ago there were pilgrims walking to the Celestial City, and Beelzebub, Apollyon and Legion, with their companions in evil, perceiving that the pilgrims' way to that city lay through this town of Vanity, contrived here to set up a fair, wherein should be sold all sorts of vanity, and that it should last all the year long.

Now, as I said, the way to the Celestial City lies just through this town, where this lusty fair is kept; and he that will go to this city, and yet not go through this town, must needs "go out of the world." The Prince of princes himself, when here, went through this town to his own country, and that upon a fair-day too. Yea, and as I think, it was Beelzebub, the chief lord of this fair, that invited him to buy of his vanities; yea, would have made him lord of the fair, would he but have done him reverence as he went through the town. Yea, because he was such a person of honor, Beelzebub had him from street to street, and showed him all the kingdoms of the world in a little time, that he might (if possible) allure that Blessed One, to cheapen and buy some of his vanities. But he had no mind to the merchandise, and therefore left the town, without laying out so much as one farthing upon these vanities. This fair therefore is an ancient thing, of long standing, and a very great fair.

As Christian and Faithful entered into Vanity Fair, the people wondered at their apparel and at their speech. The town itself was in a hubbub about them. That which did not a little amuse the merchandisers was that these pilgrims set very light by all their wares. They cared not so much as to look upon them, and when asked what they would buy answered gravely: "We buy the truth."

The behavior of Christian and Faithful so little suited the people of Vanity Fair that the pilgrims were taken and examined, and those that examined them did not believe them to be any other than mad, or else such as came to put all things into a confusion in the fair.

Therefore they took them and beat them, and besmeared them with dirt, and then put them into a cage, that they might be a spectacle to all.

Then some of the men in the fair, that were more observing than the rest, seeing the patience of Christian and Faithful, began to check and blame the baser sort for their treatment of the pilgrims. Thus, after words had passed on both sides, the disputants fell to blows.

Then were these two poor men brought before their examiners again, charged with causing the hubbub, beaten, loaded with irons, led in chains up and down the fair as an example and terror to others, and with threats remanded again to the cage and their feet were put in the stocks.

A convenient time being appointed, they were next brought before Lord Hategood for trial. They were charged with injuring the trade of the town, and with causing commotions by winning a party to their most dangerous opinions. Evidence against Faithful was given by Mr. Envy, Mr. Superstition and Mr. Pickthank, and, the jury finding him guilty, he was sentenced to the most cruel death that could be invented. They therefore brought him out, scourged him, buffeted him, stoned him, pricked him with their swords, and finally burned him to ashes at the stake. But a chariot and horses waited for him, and took him up through the clouds to the Celestial Gate.

As for Christian, he was taken back to prison, where he remained for a space, but He that overrules all things so wrought it about that Christian escaped them and went his way.

And as he went he sang, saying,

"Well, Faithful, thou hast faithfully profest
Unto thy Lord, of whom thou shalt be blest,
When faithless ones, with all their vain delight,
Are crying out under their hellish plight:
Sing, Faithful, sing, and let thy name survive,
For though they kill'd thee thou art yet alive."

When the believer has done his work, the wrath of man may be permitted to expedite his removal to his heavenly inheritance, beyond which all the malice and power of earth and hell are utterly unavailing against him.

Christian, who is here dressed in his armor, and his new companion, Faithful, came to Vanity Fair, a resort of all sorts of wicked people, which is on the way to the Celestial City and must be passed through by every traveler. The two pilgrims were very shamefully treated at Vanity Fair, Faithful being put to death.

The jury that tried Christian and Faithful for disturbing the peace of Vanity Fair with their strange doctrines was composed of Mr. Blind-man, Mr. No-good, Mr. Malice, Mr. Love-lust, Mr. Live-loose, Mr. Heady, Mr. High-mind, Mr. Enmity, Mr. Liar, Mr. Cruelty, Mr. Hate-light, and Mr. Implacable. These characters the artist tries to show in the faces of the jury; for faces often indicate character.

CAPTIVES IN DOUBTING CASTLE

NOW, I saw in my dream that Christian went not forth from Vanity Fair alone, for there was one whose name was Hopeful—being made so by the beholding of Christian and Faithful in their words and behavior in their sufferings at the Fair—who joined himself unto him, and, entering into a brotherly covenant, told him that he would be his companion.

Having passed over the little plain called Ease, and refused the invitation of one Demas that they should leave the narrow way to look at the silver-mine on the hill called Lucre, they came to a stile leading into Bypath Meadow.

The road that they had come by was very rough, and Christian, looking over the stile, saw that a path led along by the way on the other side of the fence.

"Here is the easiest going," said Christian. "Come, good Hopeful!"

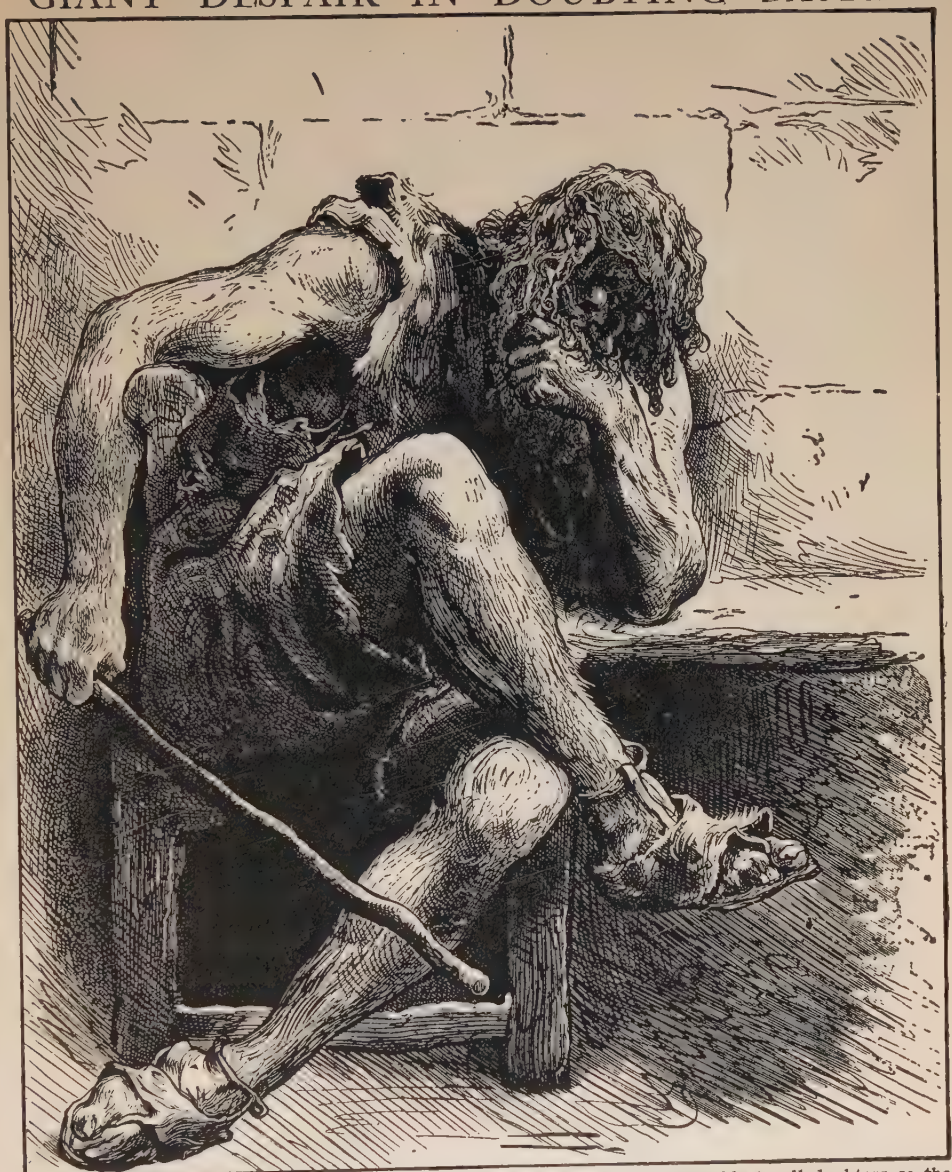
"But how if this path should lead us out of the way?" said Hopeful.

Christian remarking that it went along by the wayside, Hopeful was persuaded, and the two went over the stile, and found the path very easy for their feet. Presently the night came on, and it grew very dark; then it began to rain and thunder and lighten in a very dreadful manner. They saw they had lost their way, and Christian began to blame himself for bringing his companion out of the way.

But Hopeful comforted him and forgave him, and presently they were at rivalry as to who should go first, and so meet any danger that might lie in wait for them on the way back to the stile. By this time the waters were greatly risen, and the way was perilous. At last, lighting under a little shelter, after having been nearly drowned nine or ten times, they decided to rest there till daybreak. But, being weary, they fell asleep.

Now, near where they lay was a castle called Doubting Castle, the owner

GIANT DESPAIR IN DOUBTING CASTLE



Giant Despair, who lives in Doubting Castle and tries to make life unendurable to all doubters so that they may destroy themselves, failing which, he kills them himself. Christian and Hopeful were happily able to escape from Giant Despair, as Christian had the key of Promise, which opens Doubting Castle.

whereof was Giant Despair; and it was in his grounds that they were sleeping. And he, getting up early, saw them, bade them awake, and, driving them before him, put them into a dark and stinking dungeon of his castle, where they lay from Wednesday morning till Saturday night.

On the Thursday, acting on the counsel of his wife Diffidence, Giant Despair got a crab-tree cudgel, wherewith he beat them fearfully. On the next morning, again on the advice of his wife, he came to them and advised them to make away with themselves. And when they prayed him to let them go, he rushed upon them, and had doubtless made an end of them himself, but that he fell into one of his fits—for he sometimes, in sunshiny weather, fell into

fits—and lost for a time the use of his hands.

Towards evening the Giant went down into the dungeon again, and, finding that they were still alive, fell into a rage and threatened them so dreadfully that Christian's courage began to fail. But Hopeful comforted him by reminding him of the victory he had had over Apollyon, and how he had come through the Valley of the Shadow of Death.

On Saturday morning, the Giant, having had further counsel with his wife, had the prisoners into the castle yard, and, after showing them the bones and skulls of those he had already despatched, told them he would tear them into pieces within ten days. With that he beat them all the way back to the dungeon.

That night the Giant and his wife began to renew their talk about their prisoners; and the Giant wondered that he could neither by his blows nor his counsel bring them to an end. His wife replied that she feared they lived in hope that someone would come and release them, or that they had picklocks about them. The Giant at this resolved to search them in the morning. But about midnight on the Saturday, Christian and Hopeful began to pray, and a little before day Christian exclaimed:

"What a fool am I thus to lie in a stinking dungeon, when I might as well walk at liberty! I have a key in my bosom, called Promise, that will, I am persuaded, open any lock in Doubting Castle."

And he pulled it out. It opened the dungeon door, the outward door, and the iron gate.

The gate as it opened made such a creaking that it waked Giant Despair, who, hastily rising to pursue his prisoners, felt his limbs fail; for his fits took him again, so that he could by no means go after them. Then they went on, and came to the King's highway, and so were safe, because they were out of the Giant's jurisdiction. But at the stile they put a notice warning other pilgrims.

THE END OF THE PILGRIMS' JOURNEY

CHRISTIAN and Hopeful afterwards came to the Delectable Mountains. Here they were welcomed by the shepherds. The shepherds, whose names were Knowledge, Experience, Watchful and Sincere, had them to their tents and gave them good counsel as to their way, and showed them through their perspective glass the gates of the Celestial City.

So they went on, and behold a man, black of flesh but covered with a very light robe, came to them, and, learning that they were bound to the Celestial City, bade them follow him, for it was thither, he said, that he was going.

Now, the name of this man was Flatterer, and by-and-by, before they were aware, he led them both within the compass of a net. Then in their distress they remembered the shepherds had warned them of the man.

At last they espied a Shining One coming towards them, with a whip of small cord in his hand. When the Shining One was told that they were poor pilgrims going to Zion, he rent the net, put them in the way again, and, having chastised them, bade them go on and remember the other warnings of the shepherds.

They went on till they came into a certain country, whose air tended to make one drowsy if he came a stranger into it. Hopeful was for falling asleep, but Christian remembered that this must be the Enchanted Ground, of which they had been warned. And so, to prevent themselves from falling into a sleep from which there was no awakening, they fell to good discourse.

In time they were got over the Enchanted Ground, and entered into the country of Beulah, whose air was very sweet and pleasant. The way lying directly through this country, they solaced themselves there for a season. Here they heard continually the singing of birds, and saw every day the flowers appear in the earth, and heard the voice of the turtledove in the land. In this country the sun shineth night and day; wherefore this was beyond the Valley of the Shadow of Death, and also out of the reach of Giant Despair, neither from this place could they so much as see Doubting Castle. Here they were within sight of the city they were going to, also here met them some of the inhabitants thereof. And drawing near to the city they had yet a more perfect view thereof.

It was builded of pearls and precious stones, also the street thereof was paved with gold; so that by reason of the natural glory of the city, and the reflection of the sunbeams upon it, Christian with desire fell sick. Hopeful also had a fit or two of the same disease.

But being a little strengthened, they went on, and as they went they were met by two men in raiment that shone like gold, also their faces shone as the light. These men asked the pilgrims whence they came; and they told them. Then said the men: "You have but two difficulties more to meet with, and then you are in the city." Christian, then, and his companion asked the men to go along with them; and they said they would. So they went on together until they came within sight of the gate. But betwixt them and the gate was a river, and there was no bridge to go over. The river was very deep.

Christian and Hopeful crossing the river to the Celestial City. When their faith was strong in the King of the Celestial City, so would they find the river shallow, and when their faith was weak, the river would be deep.

The men that were with them, in answer to their questions, told them that they must go through the river, which they would find deeper or shallower as they believed in the King of the place. They then entered the water, and Christian began to sink, crying out to his good friend Hopeful: "I sink in deep waters; the billows go over my head."

Then Hopeful bade him be of good cheer, and had much ado to keep his brother's head above water. But after a while they both took courage, and Christian presently found ground to stand upon, and so it followed that the rest of the river was but shallow. Thus, they got over.

Now, upon the bank of the river, on the other side, they saw the two Shining Ones again, who there waited for them. Wherefore, being come out of the river, they saluted them, saying: "We are ministering spirits, sent forth to minister for those that shall be heirs of salvation." Thus they went along towards the gate.

Now, you must note that the city stood upon a mighty hill, but the pilgrims went up that hill with ease, because they had these two men to help them up by the arms. They had likewise left their mortal garments behind them in the river.

And I saw in my dream that Christian and Hopeful, after giving in their certificates, went in at the gate; and lo, as they entered, they were transfigured, and they had raiment put on that shone like gold. There were also those that met them with harps and crowns, and gave these to them. Then I heard in my dream that all the bells in the city rang again for joy, and that it was said to them: "Enter ye into the joy of your Lord."

So I awoke, and behold it was a dream.

. . . .

But Bunyan dreamed another dream, and in this dream he saw how Christian's wife and children set forth from the City of Destruction, and, reaching the Interpreter's house, were put in charge of one Great-heart, who guided them to the Celestial City, whither Christian had gone before them. The story of this forms the second part of his great work. In this is told how Giant Despair was slain by Great-heart, and how Doubting Castle was destroyed in seven days.

It is in this that the shepherd boy is heard singing the now famous lines:

He that is down, needs fear no fall,
  He that is low, no pride;
He that is humble, ever shall
  Have God to be his guide.
I am content with what I have,
  Little be it, or much;
And, Lord, contentment still I crave,
  Because thou savest such.
Fullness to such a burden is
  That go on pilgrimage;
Here little, and hereafter bliss,
  Is best from age to age.

THE NEXT STORY OF FAMOUS BOOKS IS ON PAGE 5901.

THE HARBOR OF VOLENDAM, A TYPICAL DUTCH FISHING VILLAGE

THE STORY OF THE NETHERLANDS

THE highest and lowest lands in Europe are linked together by the river Rhine. Far away amid the mountains of Switzerland it starts on its long journey, leaping like a merry child, till it passes into the quiet waters of Lake Constance. Thence emerging, with growing strength it dashes and roars as it tumbles over the rocks at Schaffhausen, and flows, in staid middle life, rapidly and steadily north, useful and strong and beautiful, for many, many miles through Germany. After passing the grand gate of the Seven Mountains near Cologne it goes slower, as if age had come upon it, and at last, stretching out weary arms, it seems to be blindly searching for the sea, in which to end its winding course in peace.

The triangle of low land on the shores of the North Sea between France and Germany lies in the grasp of these arms of the Rhine, and about the lower courses of the Meuse and the Scheldt where the great north plain of Europe is narrowest. It has been known through history as the Low Countries, or as the Netherlands, the word nether meaning "lower."

Small as the district is, it has fallen into two distinct countries, occasionally united under one rule. Holland, the hollow or marshy land, the northern and larger half, with her indented coast, lies chiefly in the Rhine delta. Belgium, to the south, has but fifty miles of coast, and consists of the lowlands drained by the Meuse and Scheldt, and the highlands of the Ardennes.

If we are visiting Holland we can land either at Flushing, on an island on the north bank of the Scheldt, or at the Hook of Holland, on the north side of the Meuse, which leads to Rotterdam, the great port of Holland. The channel of the Meuse is the chief entrance to the Rhine.

Between Flushing and the Hook are the numerous muddy islands formed by the sediment brought down by the great rivers, so here we have some of the earth of Switzerland, Germany and France. North of Rotterdam are The Hague, the beautiful capital of Holland; Utrecht, Leyden and Haarlem, so famous in history; and Amsterdam, Holland's largest city of commerce, on an arm of the Zuyder Zee. The Zuyder Zee is the youngest sea in the world, for it was formed only about six hundred years ago, when the water burst in over the land, sweeping away villages and farms and people. The greater part of Holland is below the level of the North Sea.

There is an old Dutch proverb that God made the sea, but man makes the shore. For more than a thousand years the making of that shore has been the first duty and thought of those who, living in Holland, wished to protect it, and enlarge its borders, against the storms and tides that dash against it.

As we travel through Holland to-day we are astonished at the engineering skill that has developed through unceasing battle with the water.

THE LAND WHERE THE FISH SWIM ABOVE AND THE BIRDS FLY BELOW

Let us stand on one of the great dikes, as the Dutch call their sea walls. It is perhaps sixty feet high, and broad enough at the top for a carriage road, bordered with trees and buildings. The sea laps quietly, though it may rage and roar to-morrow, not far below the level of this road, and boats come alongside to little piers and quays. The other side slopes deep down to the green meadows, so that we on the dike can see down the chimneys of the houses nestling below, and the fish on the one side are higher than the birds in the trees on the other. Very strong, built of stones and cement and willow boughs, are these walls which push back the ocean. Constant care is needed to see that there is no leak and that the gates and sluices are in perfect order.

There are strong walls, too, around the lakes and on the banks of the rivers that become flooded when the snow melts in the distant Alps; and everywhere are canals and ditches, cut to regulate the flow and to help the land to keep its head above water. In many places continuous pumping has to be carried on, and this is done largely by the windmills that are such a feature of the country. From the top of the dike we can perhaps count twenty or more, for the Dutch make the most of the labor of that riotous giant the wind, who often does so much mischief in the country.

THE CITY OF ISLANDS WITH ITS THREE HUNDRED BRIDGES

Besides pumping and draining, the windmills saw up wood and grind corn. Many lakes are formed by the draining of the marshes, which has been done with enormous toil and skill. As we pass from The Hague to Haarlem in the train we see one of the largest polders, as the drained marshes are called, beautifully green and fertile.

If our visit is in the early summer, the reclaimed land will be brilliant with the lovely bulb flowers for which Holland is so famous. In most of the towns canals run through the streets. Amsterdam, for instance, is built on almost as many islands as Venice, and the canals are crossed by three hundred bridges. The soil is so moist that houses have generally to be built on a foundation made firm by driving in piles. Erasmus, the great scholar who lived at Rotterdam, and did so much to prepare the way for the Reformation, had this in his mind when he said that he knew a city in which people lived like crows on the tops of trees.

Holland is so flat that there is said to be but one danger-board for cyclists in the whole country. If we mount the towers of any of the fine old churches we can see all around for miles, right away to the distant horizon. And a bright and wonderful view it is on a sunny day—quite dazzling, for the water shines everywhere, and so do the brass weathercocks and the steel railway lines; even the sails of the boats on the canals gleam against the green of the fields. It is strange to see sails mixed up with trees, especially when the rivers or canals are higher than the fields. And over all is the tenderest and most delicate light, which Dutch artists know so well how to paint in their pictures.

HOW THE DUTCH CHILDREN SKATE TO SCHOOL ALONG FROZEN CANALS

In the winter a very different scene meets the eye. Instead of the vivid green, a mantle of white rests over all, and the gleaming waters of the canals and ditches are frozen hard and are covered with skaters—doctors going to their patients, children to school, laborers to their work. The Dutch are among the best skaters in the world.

Let us leave the busy and populous Belgium of to-day and the Holland so carefully wrested and guarded from the ocean, and glance at their story. For two thousand years the Netherlanders have not only kept their small corner of Europe independent, but have so strengthened and educated themselves that for centuries they have been among the world's teachers in most of the matters worth knowing.

The Low Countries are but a dull, damp district, shut in by the gloomy depths of boundless forests, when we first catch sight of them in the early days of

THE LOW COUNTRIES OF HOLLAND AND BELGIUM

Holland and Belgium were for centuries linked together as one land, and much of Holland lies considerably below sea level.

Rome. For countless ages the rivers, which are numerous all over the land, had been steadily bringing down slime and mud, and the wind and tide had been occasionally dispersing and destroying the banks thus formed.

The early Celts who chose these shifting swamps for their home lived like beavers among the tangled brushwood on the islands at the mouth of the Rhine.

THE BATAVIANS OF OLD, WHO FOUGHT IN THE ARMIES OF ROME

The bravest of them were the Belgæ, who have left their name in Belgium. When the Romans came, several German tribes, of much the same stock as our own forefathers, had pushed out the Celts. Among them the Batavians and the Frisians were celebrated for bravery and love of freedom, and for their determination to protect the land on which they dwelt. The Batavians proved of great use in the Roman armies.

In the fourth century the Frankish tribes came swarming over the Rhine. By degrees they absorbed the Frisians and the Batavians and the rest of the tribes living in the morasses and low plains, till, in the eighth century, all the country fell under the rule of the Frankish emperor Charlemagne. He left the people their native customs, and put chiefs over them whom they had to obey.

Part of Charlemagne's plan was to give wealth and power to the bishops of the newly converted tribes, and for nearly a thousand years these prince-bishops were very important. After Charlemagne's death the empire broke up, and under the weak rulers that followed, the independent nobles became ever stronger.

THE RISE TO WEALTH AND POWER OF THE CITIES OF THE NETHERLANDS

An old law of one of the small states (Friesland) declares that "the race shall be free as long as the wind blows out of the clouds and the world stands." This principle has always been kept in view, even in times of overwhelming trouble.

But in the bad old feudal days, when the nobles were forever quarreling among themselves, and, whenever possible, doing their best to take away the liberties of the people, the prince-bishops gained more and more power over men's minds. At last no one dared to think for himself.

We know how the rise of important towns has always helped on the cause of freedom, and though the towns in the Netherlands are not quite so old as some in France, Italy and Germany, most of them date from early times. When trade was set moving by the influence of the Crusades, the towns of the great north-and-south route began to rise from small beginnings to wealth and power. From the thirteenth to the fifteenth century the towns of the Netherlands did much business with the towns of the famous Hanseatic League of traders. In the fourteenth century there were over three thousand woolen factories around Malines, now the centre of the Belgian railway lines; Ghent had 40,000 weavers, and the goldsmiths of Bruges were numerous enough to form a regiment by themselves in time of war. The towns of Delft, Haarlem, Rotterdam and Amsterdam were all growing, though often laid waste by the quarrels of landowners and townsmen.

HOW ENGLAND GREW WOOL FOR THE FLEMISH LOOMS

It was at this time that England grew so much wool for Flemish looms. Linen, too, of various kinds was added to the manufactures. Holland, that stout material used so much for overalls, is still known by the name of the country where it has always been woven on a large scale.

But all the time when trade and industry were growing, amid constant scenes of violence and fighting in the streets of the flourishing towns, the struggle against the elements was forever going on. When the fierce winds heaped up the sand in hills on the shore, the Netherlanders planted coarse grass to bind it together to make a rampart. When the river overflowed, the banks were strengthened and heightened; and so by degrees, by patient trial and endeavor, that wonderful skill was attained in making canals and draining lakes, and in building dikes that would withstand even the inward rush of the strong tide. Sometimes, as we have seen, the giant ocean had its way. It was in the thirteenth century that it rushed inland and formed the Zuyder Zee. For years past they have been preparing plans to drain this great body of water and restore the land to cultivation.

All this effort for generations produced a wise and determined race. Though few in numbers, and living in a small country, yet they were able to resist in the

SCENES IN THE HOLLANDER'S HOME

Fishermen of Volendam.

A happy group in Volendam.

Old windmills at Zaandam.

The village sweetshop.

Fishermen of the Zuyder Zee.

Delivering milk in Zealand.

fifteenth and sixteenth centuries the fierce tyranny of the most powerful of the sovereigns of Europe.

For a dark cloud began to grow over the Netherlands when, by seizure, purchase, succession, marriage of heiresses, the most considerable of its states passed under the sway of the dukes of Burgundy. These dukes wished to annex Switzerland as well as the Netherlands and make one long independent kingdom between France and Germany. The crafty Louis XI had very much to say about this, and was at constant warfare with Duke Charles the Bold. From the daughter of this bad and bold man was wrested the Great Charter. This led to the first regular assembly of the states-general, the members of which were sent from the provinces and great cities of the Netherlands.

The young duchess Mary married Maximilian of the Hapsburg family, and their son Philip succeeded to his mother's dominions and married the daughter of Ferdinand and Isabella of Spain. Philip's son was the famous Charles V, who gathered into his hand the rule of the Netherlands with that of Spain and Austria. All these countries hated each other, and the liberties of the Netherlands were in terrible danger from a prince who firmly believed that he had the sole right of disposing of the persons and lives of his subjects, as well as settling their faith and religion.

THE KING WHO PERSECUTED THE PEOPLE OF THE NETHERLANDS

Charles, in spite of his wide empire, was always in want of money, and he required the rich cities of the Netherlands, especially Ghent, to furnish it whenever he chose to ask for it. When denied, he took away all the charters and rights of those who opposed him, and fined and executed the citizens. Hard as this was, especially when trade from different causes did not bring in so much wealth as formerly, it was not to be compared with the suffering inflicted on the country through Charles's tyranny in matters of religion.

We know how the teaching of Luther raised a storm in Germany and in England. Calvin, another reformer, powerfully affected France and the Netherlands. In these countries the rulers hated and feared the Protestants, not only because their beliefs were contrary to established doctrine, but also because they denied the absolute power of the rulers themselves. So, as the Netherlanders became more and more convinced that the Reformation was right, and bent all the strength of their determined natures to uphold it, the more bitter became the persecution of those in power, in order to stamp it out. Charles established the terrible Inquisition in the Netherlands, and some of the reformers were burned under his orders.

THE PITILESS MAN WHO SENTENCED A WHOLE NATION TO DEATH

His son, Philip II, carried out his father's plan only too well. When the unhappy people prepared to rise in revolt against his cruelties, he sent the Duke of Alva, a clever soldier and a man absolutely without pity, to suppress them. Almost the entire population of the Netherlands was sentenced to death without even the form of a trial, and people were seized and killed without warning, till there was not a family that did not suffer bereavement.

A national hero rose up at this time in William the Silent, Prince of Orange. William was brought up under the eyes of Charles V. When the worn-out emperor laid down all his crowns to go into a monastery, it was on William's arm that he entered the great hall at Brussels, where the ceremony of renunciation took place.

William very soon ceased to be friends with Philip of Spain, though for years he was called his lieutenant. After he openly became a Protestant he was leader of the opposition to the bloodthirsty Alva. The patriots called themselves, at first in grim jest, the Beggars. Sometimes they won, especially at sea; sometimes the Spaniards had the best of it; and the struggle went on for many years.

HOW THE MEN OF LEYDEN CUT THE DIKES AND SAVED THEIR CITY

Stories of the heroism shown in this war of independence are told of every town of the Low Countries. The sieges of Haarlem and of Leyden are among the most memorable. Leyden held out a whole year, except for a brief respite, and the heroic defenders were reduced to starvation, but would not give in. There were fights on the slippery ice in the bitter winter. As a last resort the dikes were cut, and the water flowed

WATER LENDS ENCHANTMENT EVERYWHERE

A fine waterway in the historic town of Leyden.

In quaint Dordrecht.

Coast village of Zoutlande.

The old gothic church at Dordrecht, as seen from Kalkhaven.

over the hardly won fields, forcing the Spaniards away in haste lest they should be drowned, and allowing the ships that had been waiting to come right up to the walls of the town, with their precious food for the starving inhabitants.

After a while the provinces of Holland and Zealand united. When they felt strong enough, they took the important step of renouncing the authority of Philip. England helped them cautiously, and one of the bravest of the English volunteers who pressed across the North Sea to help the Netherlanders was Sir Philip Sidney, whose story is told on page 2007.

But scenes of war, of sacking fine cities, of senseless cruelty in persecution, could not last forever, and after several unsuccessful attempts at union and at making peace with Spain, Dutch independence was declared in 1581. William the Silent, affectionately called "Father William," was the head of the new republic. It was nearly seventy years before Spain gave up all her claims and titles and acknowledged the complete independence of the Dutch people.

How the children cried when William the Silent was killed

The victory was followed, as has so often been the case in history, by a tragic act. Three years after the Declaration of Independence the wisest man in Holland was murdered by a Burgundian hired by Spain. As long as William the Silent lived he was the guiding star of a brave nation, and when he died, the little children cried in the streets.

No man in the history of the world has deserved more truly to be called great than this silent Dutchman. To understand him we must realize what he left to take his stand on the side of right. He was not naturally grave and thoughtful. He was inclined to live happily for the enjoyment of the moment. He was rich and fond of luxury. He was a Catholic in religion, and a friend of the great Catholic kings of Spain and France at a time when the clash of religious beliefs was most fierce. If he had been content to see injustice and cruelty flourish, it would have been quite easy for him to stand aside and let religious strife take its own disastrous way apart from him.

But William was honest enough in feeling, and bold enough in thought, to see that the torture and murder of people for believing what they cannot help believing is utterly wrong, whether done in sheer tyranny or in the name of religion. His manhood revolted from the hideous persecutions that were deliberately introduced into the Netherlands and were countenanced alike by Spain and France.

The honest prince who did what his heart said was right

He gave up the natural brightness of his life, his wealth and his ease, and he faced danger, slander, poverty and outlawry on behalf of what his heart told him was right. He was shocked out of the religion of his youth. Whatever came, he must be faithful to the best within himself; and he remained triumphantly faithful even to death by the hand of a hired assassin. William the Silent, the great man of Holland, is the typical great man of all mankind—great in soul; and so he will ever remain a man for coming men to know.

War still went on under his son Maurice. The southern states, with their great towns of Antwerp and Ghent and many others, were reduced to obedience to Spain for many years after the northern states became free. Protestantism had been stamped out, the brave and clever Flemish workers had been driven away to Holland or to England, to the great and lasting benefit of these lands; and the subdued country lay in poverty and exhaustion. Ten years after the rout and ruin of the Armada, started by the fireships and the storm off the coast of Flanders, Philip died, after a cruel reign of forty-two years.

Philip II, one of the great destroyers of mankind

He has been called a destroyer of mankind, for he sacrificed many lives to his ambition and belief. We can think of him sitting at his desk in his palace in the Escurial, planning the affairs of the world—the oceans were to him but Spanish lakes—coolly arranging assassinations and executions; squaring his money matters—his bribes and his losses. And then his long day was done.

It was in 1600 that Queen Elizabeth formed the East India Company to trade abroad, as all commerce had been so hindered by the ambitious plans of Spain. Holland followed suit two years later. Much money was spent on fleets and ports and factories. From these days the sailors of Holland—trained in the wild fishing-grounds of the North Sea—

AMSTERDAM, HOLLAND'S STATELY CAPITAL

Oude Schans, a busy waterway in Amsterdam.

Prinzengracht canal in Amsterdam.

Old houses by a canal, Amsterdam.

The Rijks, or National Museum, at Amsterdam.

were to be found all over the world taking possession of the Spanish and Portuguese colonies, and often hotly contesting with the English. New Amsterdam, afterward New York, was founded on this side of the Atlantic, and many old New York families are proud of Dutch descent. The city of Batavia was founded in Java, called after the old island province, the kernel of the mother country. To this day Batavia is the headquarters of the Dutch East Indies. Amsterdam and Rotterdam and all the old cities now revived, as trade flowed in with the arrival of ships laden with "sugar and spice, and all that's nice," at the busy quays.

How the lakes and marshes were changed into rich meadow lands

As soon as peace gave leisure, pumping works were established to drain lakes and marshes, and the rich meadow land thus gained fed the finest cattle in Europe. Dutch butter and cheese have long been famous all over the world. Another use to which the land gained from the sea was put, was to grow roots for food and various bulbs of beautiful flowers, like tulips. The Dutch taught all Europe how to garden and farm. At this time, also, Holland became the printing-house of Europe, sending out thousands of books of history and travel, law and medicine.

Trades, too, such as diamond-cutting—still carried on in Amsterdam—gave employment to large numbers of skilled workmen. It was in the seventeenth century that the rivalry between the Dutch and English on the high seas came to a crisis. There were many famous admirals, many brave seamen on both sides. Van Tromp and De Ruyter are names as well known to us as Blake and Monk. For years they tried to sweep each other off the narrow seas. London was in a panic when De Ruyter sailed up the Thames in the days of Charles II. Sometimes the obstinate sea battles lasted three or four days, for both sides belonged to a stock that never knows when it is beaten.

The sudden thaw that saved the country from its enemies

In the age of Louis XIV France made several conquests in the Netherlands, and to save the country the dikes were opened. Later the waters froze, and when the French troops were marching over the ice to attack The Hague a sudden thaw saved the country from destruction. The head of the republic at this time was the great-grandson of William the Silent. His name was also William, and he married the daughter of James II of England. When England could no longer bear the tyranny of the Stuarts, William was invited over to be king in James's place. He helped to restore old laws and liberties, and to strengthen the position of the reformed religion. In the eighteenth century the importance of the united provinces of the Dutch Republic became less than it had been in the seventeenth. There were many disturbances in the country, which led to the interference of the king of Prussia. But the French Revolution was at hand, and before long the map of Europe was completely changed, and bewildering changes came to the Low Countries, both north and south. The seven united provinces were turned into the Batavian Republic, and a few years later Napoleon turned it into a kingdom for his brother Louis. But that did not last long. He soon took his brother away, and joined Holland and all the other provinces to France. "They are but the sediments of French rivers," said he, "and therefore clearly belong to me."

Why Belgium and Holland became two kingdoms

When the Congress at Vienna remade the map of Europe after Waterloo, the whole of the Netherlands was joined into one kingdom under another William, Prince of Orange. But the northern and southern provinces did not agree about religion, the south being chiefly Roman Catholic, and they differed on many other matters, too. In 1830 they revolted. The old Spanish Netherlands became the kingdom of Belgium under a German prince, Leopold of Coburg, whose great-nephew Albert I now reigns. The northern provinces went on as the kingdom of the Netherlands, or Holland.

In the cities of both Belgium and Holland the story of the past is always before our eyes. Fine cathedrals and churches, grand town halls and buildings of all kinds, together with the pictures and relics they contain, are like speaking witnesses which tell us the bygone story.

Between Amsterdam and the sea is the famous North Sea canal, which saves ships going round the peninsula of north Holland. It is about fifteen miles long. Both at Amsterdam and Rotterdam, in ordinary times, the trade is enormous.

HERE AND THERE IN HOLLAND

Cathedral Tower, Utrecht.

Church at Delft.

Town Hall, Middelburg.

The beach at Scheveningen, the well-known holiday resort.

Railway bridge at Rotterdam.

Market square, Middelburg.

The new town, Leeuwarden.

Signal station, Hook of Holland.

Holland is one of the oddest and most amusing countries in the world. Though water is everywhere, there is often not a drop fit to drink, and people have to buy it by the pailful, as they often buy some firing to boil their kettles. From the high dikes frogs can look down on the birds, and in the damp fields the cows wear coats. Water-omnibuses ply for fares on the canals, and coal and peat are brought by brown-sailed boats, which are hitched up to the door like a horse.

The peasants wear beautiful gold ornaments and costly lace on their heads, and often a shabby French bonnet also. Dogs draw little carts with brass jars full of milk. The brass and copper shine like gold, and everything that can be scrubbed is scrubbed at least once a week, even the railway stations.

HOLLAND'S PART AS A NEUTRAL IN THE DAYS OF THE WORLD WAR

When the World War broke out, in 1914, Holland and Belgium were in a perilous position. Both countries barred Germany from a stretch of seacoast which she wanted, and which would have increased immensely her opportunities of attack.

But Germany had too many enemies to make another enemy of Holland. Besides, Holland, as a neutral country, was a protection against a flank attack from the North Sea, and would keep an open way to the sea for trade if the British fleet blockaded the German coast. So Holland was left alone, and during the war sold much food to her neighbor.

A LITTLE NATION AND ITS GREAT POSSESSIONS OVERSEAS

As might be hoped from its fine history in the cause of freedom, Holland remains one of the great little nations of Europe. Successful as the Dutch have been in capturing and defending their land from the rivers that pour into it, and from the sea that attacks it, Holland would not have occupied anything like the place she holds in the world if the perseverance of her people as seafarers had not carried them overseas, and won and kept an empire nearly as far away as half round the world. The Dutch colonies in the East Indies, with their much smaller holding in South America (Dutch Guiana or Surinam), have a population close on fifty millions. Thus little Holland, about seven times the size of Prince Edward Island, is one of the very considerable countries, ruling 57,000,000 people at home and abroad.

The only part of Holland that is hilly is the southern half of the inland province of Limburg, which juts out between Belgium and Germany, and reaches a height of a thousand feet. In this district some coal and iron are found; otherwise Holland depends on other countries for her mineral needs, apart from her colonies, which produce some tin and good supplies of mineral oil.

The mainstay of Holland is in her agriculture, her fisheries, shipbuilding, carriage of goods, and the marketing of her colonial produce. Thirty-five per cent of the whole of Holland is laid down in pasture, and her dairy produce and manufacture of margarine are important. She is also a cattle-breeding country and has a good breed of horses. Some lines of her manufactures are connected with her colonial produce, such as cigars, tobacco, cocoa, chocolate and sugar, and she is a distributer of Eastern spices.

HOW HOLLAND HELPS TO FEED THE BRITISH ISLES

The chief products of her arable land are rye, potatoes, oats, beets and wheat. Holland has always claimed and taken a liberal share of the fisheries of the North Sea, especially its herring catch, and she has a considerable export of fish.

Her garden and vegetable trade takes a regular place in the English market with potatoes, cauliflowers, cabbages, onions, asparagus, and especially all kinds of bulbs—hyacinths, tulips, crocuses and narcissus. The Dutch farmers and gardeners are careful, persistent and methodical.

The historical energy of the Dutch overseas shows itself in the prosperity of their two great cities—Amsterdam, with its 700,000 inhabitants, long a great centre of commerce and finance; and the vigorous seaport of Rotterdam, with half a million people. Other ports, chiefly with a Channel trade, are Flushing and the Hook of Holland.

The capital, known as The Hague, has a population of 365,000, and has become the world's centre for international law, very properly for three reasons. The Hollanders have a fine history as a freedom-loving people. The first great international jurist, Grotius, was a Hollander. And the country occupies a neutral posi-

SCENES IN THE DUTCH COLONIES

Native houses on the water front at Macassar, Celebes.

A typical house in Sumatra.

A woman of Java weaving.

A native band in Java.

Guests at a native wedding in Java.

The fine wharf at Batavia, the seaport of Java.

Photos, Den Boer, E.N.A., McLeish.

tion as a small country, yet important, hemmed in the midst of powerful countries such as Great Britain, France and Germany. So placed, she may well represent moral rights. The sensitiveness of some nations finds a cause for jealousy even in a simple matter like the choice of a place where international consultations may be held. This has led to the frequent choice of cities either in Holland or Switzerland for such meetings. There is an implied compliment in the fact that no nation can find ground for suspicion in these neutral countries.

THE SPLENDID UNIVERSITIES FOR WHICH HOLLAND IS FAMOUS

Holland has, too, an honorable position in education. Her university of Leyden, in a town of 65,000 people, dates from 1575, and has been a centre of liberal learning ever since. Amsterdam, too, has an old university, now municipalized, and the city was finely associated in the past with printing when knowledge was feared by people who dreaded truth. Amsterdam still has a prominent printing trade. Other university towns are Utrecht and Groningen.

Holland is chiefly a Protestant country, about three-fifths of the people accepting the Protestant faith; but the Roman Catholics form a strong minority.

It is not generally remembered that, in the days when the Dutch were competing throughout the world with the Spaniards, Portuguese, English and French for distant trade and empire, it was they who, claiming the right to share in American colonization, founded what is now the second largest city in the world. New York, as we have seen, was originally a settlement of Dutchmen and was named New Amsterdam. South Africa was largely colonized at first by the Dutch as a halfway connecting link with their East Indian possessions. Over large areas of the British South African Union people of Dutch descent form a majority of the white inhabitants.

JAVA, THE GREAT DUTCH POSSESSION IN THE INDIAN ARCHIPELAGO

The chief settlement of the Dutch in the Indian Archipelago was, and is, in the island of Java. Its capital, now a city of 140,000 people, was called Batavia, after a tribe of Batavians who originally lived in Holland between the two branches of the Rhine as it approaches the sea.

Java, about the same size as Alabama, is unsurpassed in the richness of its vegetation. It is thickly peopled by the yellowish brown Malay race, numbering 35,000,000, who are Mohammedan in religion. The second most important town is Samarang.

The land of Java is assumed to belong to the Government. It is nationalized, but may be sold. It grows rice, sugar, cinchona (for quinine), coffee, tobacco, tea and indigo. Petroleum is one of the most valuable of the island's products, and rubber is very important. The great natural disadvantage of Java is a liability to earthquakes. The island has been so governed by the Dutch that it offers a good example of life by a less advanced race under European direction.

Other Dutch colonies in the East Indies are: Sumatra, more than six times the size of New Brunswick, with a population of nearly 6,000,000, exporting pepper, nutmegs and mace; Celebes, about half the size of California, with a population of 3,000,000; Dutch Borneo, with a population of 1,600,000; and Timor, with over 1,000,000 inhabitants. Dutch Guiana is twice the size of Nova Scotia, has a population of 100,000, and exports bananas and coffee. The capital, Paramaribo, has 50,000 inhabitants.

HOW THE COLONIES HAVE HELPED HOLLAND TO EXTEND HER TRADE

Holland is an interesting example of the advantages a European country may derive from her colonies. There can be no doubt that her possessions in the East have stimulated her home industries and her commercial enterprise. She has carefully nursed her outlying possessions from the first, and used them to extend her trade; but her civilizing influence has also been felt by the native races she controls.

Many European peoples regard the Dutch, from outside their borders, as a quaint, industrious race, oddly dressed in the rural districts, prosperous in a quiet way, living in a dead flat land of doll-house architecture ornamented with windmills, or sailing the seas in broad-beamed ships. This is true; but a bigger truth is that they have held their own in the world with shrewdness, industry and energy, and from a foundation, mostly of water-sodden soil, ungifted with earth's natural riches, have built up an empire that commands the world's respect.

THE NEXT STORY OF ALL COUNTRIES IS ON PAGE 5691.

This picture illustrates the effect of heat on solid bodies. When a railway line is laid down, space is always left between the rails, as can be plainly seen, to allow for their expansion through heat.

HOW HEAT WORKS FOR US

WE know that when things are hot they have power which can be used. The most famous case of this, which set the clever boy James Watt thinking, is the case of the lid of the kettle of boiling water. The heat put into the water has the power of making the lid move. Now, if heat in the form of steam can make the lid of a kettle move, why should it not start motion in something attached to a wheel? The answer to this question is supplied by every engine driven by heat all the world over to-day.

On the other hand, just as heat can do work, so work can make heat. One of the old ways of lighting a fire was to rub together two pieces of wood, which produced heat enough to make a spark. Anyone can prove that heat can be produced by work if he rubs his hand on a coat.

The work of rubbing or striking a match puts heat into it, and when it is hot enough it catches fire. In a word, the kind of motion we call heat can be turned into ordinary kinds of motion, like that of a wheel or the lid of a kettle; and ordinary mechanical motion, as it is often called, can be turned into the special motion which is called heat.

It is worth while to know the simple way in which this may be stated in scientific language. The Latin word *moles* means "mass," and from it we get the word "molecule," which means a little mass. Now, when a visible thing is in motion we may call it a case of *molar motion*—the motion of a mass. But heat, which is a case of the motion of the molecules of things, may be called *molecular motion.* So we may say that molar motion may be turned into molecular motion, and molecular motion into molar motion; in other words, work may be turned into heat, and heat may be turned into work.

But if we think of heat as molecular motion and of work as molar motion it seems reasonable that one kind of motion should be turned into the other, and also that there must be an absolutely fixed amount of either kind of motion that can possibly be got from the other kind. If that is not so, some motion is being got out of nothing, or some motion is being made into nothing; and we are sure that neither of those things can happen.

What we have just been saying makes the basis of a great and important science called *thermodynamics.* We might translate that into "heat-force"; and this great science deals with all the relations existing between heat and power. This science bears

not only in the making and working of all machines made by men, but on the history and the future of the living and eternal machine which we call the universe, made from everlasting to everlasting by God.

A LAW THAT WAS PROVED AFTER TWO THOUSAND YEARS

The law of the conservation of energy has been established by the study of heat and work. Before the birth of Jesus great thinkers guessed that what we now call the law of the conservation of energy must be true; but the proof of its truth had to wait until the nineteenth century. It depends on whether the amount of work we can get from a certain amount of heat, or the amount of heat we can get from a certain amount of work, is absolutely fixed. We have begun to see why this must be as it is, because we see that, after all, it is only a case of changing one kind of motion into another kind, and that is the thing we see and do for ourselves every day.

A famous Englishman named James Prescott Joule proved, nearly a hundred years ago, that there is a certain amount of work which can be got out of a certain amount of heat; and nowadays we use J, the first letter of his name, to mean the amount of work which can be got out of a certain known or measured amount of heat.

HOW HEAT CAN BE CHANGED INTO WORK, AND WORK INTO HEAT

Thus we take the amount of heat which can raise the temperature of one pound of water at 60° Fahrenheit up to 61° Fahrenheit, and we find that that amount of heat is equal in power to raising 778 pounds through a height of one foot, or one pound through a height of 778 feet. But what the exact figure is, matters nothing at all compared with the all-important fact that this relation actually does exist.

The first law of this part of science is, therefore, that between heat and work there is a constant relation; that either can be transformed into the other. But there follows a second great law which says that, though the first law is true, heat will travel only from a body that is higher in temperature to one that is lower.

The first law is another way of putting the law of the conservation of energy, but the second law says that, though energy is never lost, there are only certain conditions under which we can use it so as to get work done. The energy may be there, but it may not be available, and that is true of all heat wherever it is found, except where it can flow to something that is less hot. For practical use for doing work it is not sufficient that energy be not lost: we must be able to get at it.

Every machine that is run gets warm, and the warmth is given away to the air around it. Our bodies, which are living machines, though they are also more, are always losing heat to their surroundings. Indeed, it is a general rule that other forms of energy, such as the chemical energy in our food or the chemical energy in the food or fuel of an engine, tend to be turned into heat, and the point is that this heat gets scattered and cannot be used over again.

THE MACHINE THAT GIVES HEAT WHEN WE WANT IT TO GIVE WORK

Let us see how this affects the engineer. It means that when he makes and uses a machine from which he wants to get work, only part of the energy he puts in comes out as work, and much of it comes out as heat. This heat is not only useless, as a rule, but worse than useless, and much trouble is taken to see that the engine does not become too hot to work.

The world, as we know it, is at present living on its supply of coal, and doing so at a tremendous rate, but far less than one-tenth part of the energy contained in the coal is really used by mankind. The rest is frittered away into the air as heat, and wasted. An ordinary grate fire is perhaps the most wasteful of all ways of transforming energy. If we look at any of the engines at work we find that they can all be studied from this point of view. How much of the energy put into them comes out as work and how much is wasted as heat? We are not far wrong if we say that in many cases one-tenth of the energy is used and nine-tenths is wasted.

Anyone who could invent a machine that would turn into work all the energy put into it, or half, or one-third, or one-quarter, would soon be the richest man in the world. So important is this question that men are working at it everywhere. The word they use is the famous word "efficiency," and their business is to try to increase, if by only one per cent, the efficiency of the engines they are working at—that is to say, the proportion of work

they do compared with the amount of useless heat they produce.

THE SECRET OF POWER IN OUR MUSCLES WHICH NO MAN CAN DISCOVER

The most efficient engine in the world is a living muscle, but the secret of its efficiency has yet to be discovered. Even a muscle, however, does not turn into work all, or even half, of the energy supplied to it; the rest is turned into heat. This heat has to be looked at very differently from the heat produced, say, in the engine of a motor car, for it keeps our bodies warm and maintains them at the temperature at which we can best live. A muscle is vastly superior to any machine ever made.

Nearly all chemical changes produce heat, and that heat is scattered and lost. Every kind of motion, besides the motion of machines, is in some degree turned into heat by friction, and that heat is scattered and lost. And so we have to learn a new idea which goes along with the great truth of the conservation of energy, and must always be remembered together with it—that, though no energy is ever lost to the world, it may very easily be lost to us.

THE HEAT FLOWING FROM THE SUN AND FOREVER PRODUCING WORK

We may classify energy in all its forms according to its usefulness for us, and then we discover that it is the general tendency for energy to be *degraded*—to fall in the course of its changes from a more useful to a less useful class. The general end of these changes tends to be that the energy is degraded to the lowest class of all—that of scattered heat, which we cannot use at all. An instance of energy in the highest class is furnished by the energy of the sun—a body which is far hotter than its surroundings. The flow of heat from this hot body to less hot bodies produces work, as the downward flow of water from a height may do work.

We have only to consider for a moment what happens to the sun's radiations to see that, in the course of every change which the power of them undergoes in our bodies or elsewhere, a certain amount is frittered away as heat, and so this energy of the highest class is degraded to the lowest. We do not suffer, and we are not alarmed, and the reason is that there is always a fresh supply of energy coming from the sun. But that supply, though it will last a long time, cannot be endless.

Now that we know what the *degradation of energy* means, we must learn the use of another word, first used by Lord Kelvin. He spoke of what has ever since been known as the *dissipation of energy*. When we speak of a foolish man who dissipates his fortune we mean that all his money is spent and scattered, and that is what is meant by the dissipation of energy.

WHY WE CAN NEVER GET A REALLY PERFECT MACHINE

We know that if gravitation were unopposed, the whole of the matter in the universe would all be gathered together into one mighty heap. In the same way, if all the energy in the universe is steadily degraded and dissipated, taking the form of scattered heat, it will become useless.

If we had a perfect machine we should be able to work it backward as well as forward, turning heat into work and work into heat, and never losing anything. There is no such machine, and, according to Lord Kelvin, not even the universe itself is a perfect machine, for it has a bias toward working in one direction, which is the dissipation and degradation of energy.

If the idea of the dissipation of energy is really true, and the whole truth, it means that the universe must be traveling toward a state of things in which nothing happens—a state which we might describe as the death of the universe. Its matter and energy would still be there, but they would have lost their power of doing anything. Nothing would happen, there would be no life and no motion of any kind. This idea makes us think of the universe as a great clock, made, wound up and set going. Here we are faced again with the idea of a beginning and an end to the history of the universe. Thus, if we take our solar system as a case in point, we see that just because the heat-level is higher in the sun than in the planets, heat flows from the sun to the planets, and so life is possible on the earth.

THE WINDING-UP OF THE CLOCK OF THE UNIVERSE

But the spreading-out and leveling of the heat in the solar system must some day come to an end, and with it must end, not only life, but all the other processes in the solar system which depend on this difference of heat-level. The prospect of the theory of the dissipation of energy is that the solar system and the whole universe must at last reach a stage in which all the other forms of energy have been degraded and dissipated into heat, and

that heat will be spread equally through all the matter of the universe. That would be the end of its history.

We may slightly change the words of a great student who summed up the case, as it was then thought, at the end of the nineteenth century, and who spoke as follows of the doctrine of the dissipation of energy: This remarkable property of all natural processes seems to lead us to the idea of a definite beginning and to shadow forth a possible end; the interval which contains the life or history of nature being occupied with the slow but inevitable running-down, or degradation, of the great store of energy from an active to an inactive or unavailable condition.

THE THOUGHTS OF HERBERT SPENCER ARE BEING JUSTIFIED TO-DAY

Herbert Spencer stood alone among the great thinkers of the nineteenth century in declining to accept the doctrine of the dissipation of energy. He saw that the argument for the dissipation of energy was not complete. He declared that there must be other processes going on, none the less real, though not so easy to see, which were, so to speak, winding up the clock while other processes, which we could see, were tending to run it down.

Steadily, during the last ten years, this idea of the dissipation of energy as *completely* true has been losing credit among those who study these matters. Processes and possibilities in the universe are being discovered which lead us to believe that it is indeed a perfect and eternal machine, besides being very much more.

The more deeply we study, the more convinced we are that the real answer to this question is the same as the answer to the question about the results of gravitation. There we find that what seems to be a process all in one direction, which must have a beginning and an end, is only half the truth. In the same way we are beginning to discover the processes which act in the other direction, and which will lead us to the belief, the belief of the wise of all ages, that the universe is from everlasting to everlasting.

WHY TEMPERATURE IS NOT THE AMOUNT OF HEAT IN A THING

We have now learned enough to show us how extremely important is the question of temperature, and by temperature we understand heat-level. It is difference of temperature that gives heat the power of doing work. That difference of temperature means that the heat will flow, and in flowing can be made to do things. Now, what exactly is difference of temperature? Indeed, what is temperature at all?

Our first inclination will be to answer that the temperature of a thing is the amount of heat in it, but we shall find that that is not true. It is true that if we take a given amount of a given thing and add heat to it, it will get hotter; its temperature will rise, and the rise of temperature means in that case that there is more heat in the thing.

But even if we take a given thing, such as water, we find that to raise a given quantity of it one degree in temperature at some level in the temperature scale requires rather more or rather less heat than to raise its temperature one degree when it is much colder or much hotter to start with. Then, again, there is much more heat in a lot of cool water than there is in a very little water that is hotter, so that again we cannot say that temperature is the amount of heat in a thing. We must think of temperature as if it were like the level of water. Even a little water falling from a great height into a large lake has something about it which the lake has not. For instance, it will turn a wheel. Now, temperature is like the level of water, and has no more to do with the amount of heat, as such, than the mere bulk of water has to do with its power. There is something in the slender waterfall that there is not in the lake below, and that something corresponds to the height from which it falls, and enables it to do work. So the temperature of a thing may be compared to the height from which the water falls in the other case; and, other things being equal, the higher the temperature, the greater is the work the thing can be made to do as it cools.

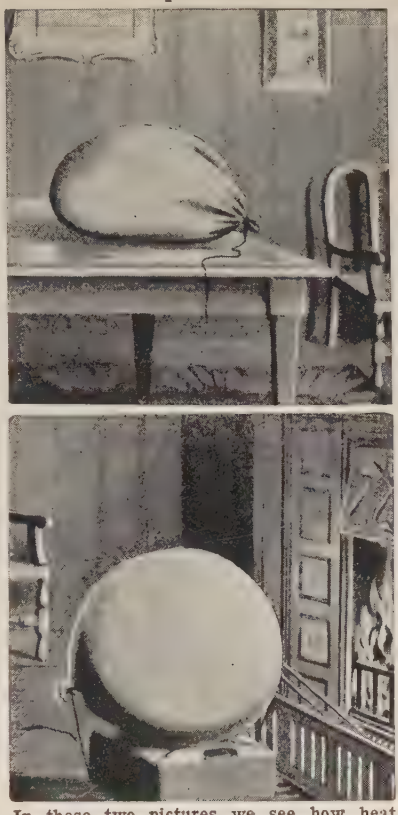
The word *thermometer* really means "heat-measurer," but we are now ready to learn that, though the thermometer is called a heat-measurer, it is not a heat-measurer, but a measurer of heat-level. Think of the water falling into the lake, and we see the difference. The thermometer corresponds to an instrument telling us what height the water fell from, but nothing about the quantity of water falling. The thermometer tells us nothing about the amount of heat, but only about the heat-level.

The first thermometer was made by

Galileo more than three hundred years ago. It was an air thermometer—a glass tube ending in a bulb. This tube was heated and then turned upside down in a vessel of water. As the air inside the bulb, which had been heated, began to cool the water ran up the tube.

The air inside the bulb would occupy more space if it were hot and less if it were cold, and the water would run up the tube accordingly. So, by the height of the water something could be told as to the temperature of the air. Now, directly we consider this we shall see, from what we have already learned, that this instrument was a barometer as well as a thermometer, for the water would partly be pushed up by the pressure of the air.

In this form the instrument was not, therefore, very useful, for no one could tell to what extent it was measuring the pressure and to what extent it was measuring the temperature of the air. What was required was to close the tube altogether after heating it, so that the atmospheric pressure should have no effect on what happened inside it. This was not done until half a century after Galileo's first great invention.



In these two pictures we see how heat affects a gas. If a balloon is half filled with air, as in the first picture, and placed in front of a fire, the air, as it gets hot, expands and fills the balloon, which will at last burst.

If we wish to make an ordinary thermometer we take a fine tube with a bulb at one end, and fill the bulb and part of the tube with mercury. Then we boil the mercury. This means that part of it forms a vapor, which travels up the tube and pushes away the air in front of it. While this is going on we close the end of the tube and allow the mercury to cool. A practically empty space is then left above the level of the mercury in the tube, and, if the mercury has any reason to expand or contract, it will be able to do so without difficulty in either direction.

The hotter mercury is, the more it swells and the more space it takes up; the colder it is, the smaller the space it takes up. Therefore the level of the mercury in the tube tells us how hot it is.

Though some students think that Galileo made a closed thermometer as early as 1612, the weight of evidence seems to show that the first sealed thermometers were made in Italy in 1641. They contained alcohol. The word thermometer was first used in 1624.

The next thing was to decide upon some fixed points from which to measure. Several men suggested the freezing-point of water as one. Sir Isaac Newton suggested the temperature of the body as the other, and wished to divide the scale between into 12 degrees.

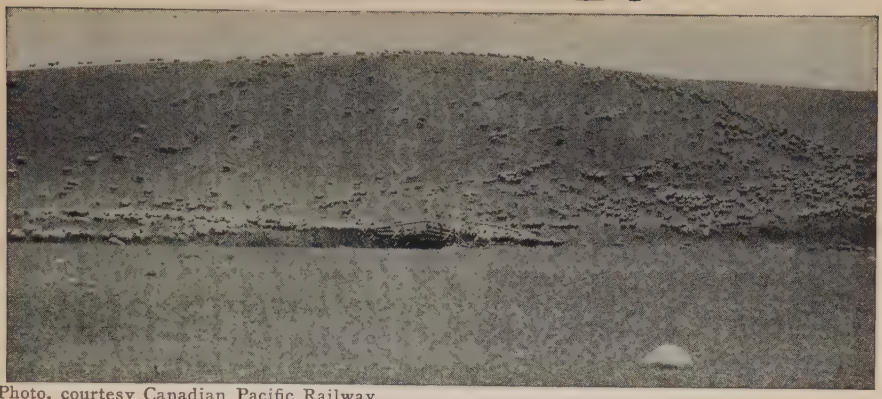
In 1714 Gabriel Dante Fahrenheit, a German scientist and instrument-maker, suggested that the lowest temperature to be obtained by ice and salt be taken as zero and the temperature of the human body be taken as the upper point, and that the range between be divided into 96 degrees. Fahrenheit showed that the temperature of boiling water was always the same at the same pressure, and in his scale the freezing-point of water was around 32° and the boiling-point around 212°. This is the scale we commonly use.

Scientists found this scale rather clumsy because the zero point really does not mean anything in nature. So in 1742 it was suggested that the freezing-point and the boiling-point of water be taken as the ends and that the scale between be divided into 100 degrees. This suggestion met with favor and has been generally adopted by scientists all over the world. It is called the Centigrade scale, meaning "hundred steps."

THE NEXT STORY OF THE EARTH IS ON PAGE 5661.

PACKING WOOL IN EGYPT FOR ITS VOYAGE TO COLDER COUNTRIES

A CARGO BOAT COLLECTING WOOL ON THE BANKS OF THE NILE NEAR CAIRO.—From the painting by Frederick Goodall, R.A.



Photo, courtesy Canadian Pacific Railway.

A sheep ranch on the rolling hills of Alberta, Canada.

WOOL AND ITS STORY

WHEN we see a picture of a savage clothed in a leopard-skin, or of a lady wearing a sable coat, we quite understand that both these people, so far removed in character and country, are clothed in the coats of animals; but when we put on our ordinary clothes in the morning, do we remember that we also are putting on an animal's coat?

Our outer clothes and often our inner ones are made of wool, and wool is a product of the sheep. Though we can imitate its appearance, we cannot find a real substitute for it.

Wool is really a living part of a sheep: it is produced by the epidermal cells. The difference between wool and hair is that the wool fibre has a covering of pointed scales, or plates, overlapping like fish scales and attached to the fibre at their bases. This scaly coat can be seen through a microscope. If a wool fibre is drawn through the fingers a certain roughness can be felt. The overlapping scales, when brought together at an angle, tend to mat together, or "felt." That is why the wool of the sheep is different from all other fibres, animal or vegetable. Another valuable characteristic of wool fibre is its elasticity. This gives it a softness to the touch which is retained in the manufactured cloth. This elasticity also gives wool fibre more strength than cotton fibre possesses.

It is estimated that there are about 500 million domesticated sheep in the world, and all these are producing wool that is taken from them once a year and woven into cloth to keep us warm. This involves no cruelty to the sheep, for it is the same thing for the animal as hair-cutting is for us. The wool soon grows again, and as the shearing is done in summer, when the weather is warm, the animal does not suffer from the cold in any way, but is relieved of its burden.

As man, by careful selection and breeding, has produced hens that lay two hundred or more eggs a year in place of the few laid by the original jungle fowl of India, from which our hens are descended, so he has carefully selected sheep with the best coats and has gradually produced a race of animals that now yield on an average nearly twice as much wool as sheep yielded not many years ago.

That is a great triumph of scientific stock-breeding, and means not only that we get more and better wool, but that wool is made cheaper, because when the quantity of anything is greatly increased its price falls.

All sheep do not yield the same quality of wool, and even the same kind of sheep will produce better wool in one country than in another. The difference is caused by climate and soil. Sheep reared in Australia produce a finer wool than the same kind of sheep brought up in England.

Where wool rather than mutton is desired, merinos are generally kept. The merinos come from Spain, and in the eighth century they were mentioned as providing wool which the conquering Moors made into cloth. As the centuries passed, the breeding of merinos spread to other European countries. In 1797 some merino sheep were taken to New South Wales, where the hot dry countryside suited them so well that they are now the leading sheep in Australia. It is known that in 1801 a man named Seth Adams brought a pair of merinos to the United States, and the great flocks of the western states are of that breed. So, too, are the Argentinian flocks. In Canada the mutton or the general-purpose breeds are more popular.

A good ewe sometimes yields fifteen pounds of wool, while a ram yields from twenty to thirty pounds, though the average is much less. Some kinds of merinos have wrinkled skin, which gives more space for wool-bearing, and as a result a bigger yield. There are from 40,000 to 48,000 fibres to the square inch of skin on a merino.

The wool, or fleece, from a merino is much finer than that from English breeds of sheep, and the diameter of a fibre of merino wool may be one-thousandth or even one two-thousandth part of an inch. Such a fibre is crimpy, strong, silky and slightly oily. The oil protects the fibres, or hairs, at the roots. Sometimes dust is caught in the oil at the outside tips of the wool fibres; then the sheep looks dirty. The oil is scoured out of the fleece, and we have the white and glistening soft fibres left.

There are two other wool breeds which are important on this continent, the Delaine and the Rambouillet. Both are of the merino family, but the wool is somewhat different. Delaine comes from two French words meaning "of wool." Delaine fibres are long and can be combed and spun to make strong, warm cloth. The Rambouillet sheep has coarser wool.

Australian wool is now among the finest in the world, and there is a great demand for it. Australia possesses more sheep than any other country. In quantity and quality it is easily the first wool-producing country of the world. The United States and the Argentine Republic contend for second place.

How long the sheep's wool has been woven into fabric we cannot tell, but the practice is very old. Though the ancient Egyptians as a race did not wear woolen garments because their climate was warm, we know that some of them did wear wool. As far back as history goes, and still farther, the production of wool has been a great industry, for almost from the beginning men have kept large flocks of sheep as part of their wealth. The Bible is full of references to sheep and wool. Virgil, the Roman poet, knew all about the ins and outs of sheep-farming, and his descriptions of the work of the shepherd might almost have been written to-day about the big sheep-stations of Australia.

THE DAYS WHEN SHEEP-FARMING WAS ENGLAND'S CHIEF INDUSTRY

England's prosperity in the Middle Ages was built up largely on wool, as sheep-farming was the principal national industry. English sheep produced fine wool that was exported to the Continent, and there was woven into cloth, chiefly by the skilled weavers of Flanders.

Later, Flemish weavers went to England, and the woolen manufacture grew up, encouraged and protected by the kings as a source of revenue. Edward III, for instance, prohibited the export of wool from England, and he also forbade the importation of fine woolen cloths from Flanders, his purposes being to deprive foreign competitors of their raw material and to encourage the English weavers to produce the better and finer kinds of cloths they had before neglected.

After a time the weaving industry became very important, and the splendid parish churches of East Anglia, almost like cathedrals, are a testimony to the wealth and prosperity of that part of England, which was the first seat of the woolen industry.

The first record of the manufacture commercially of cloth in the United States from wool is that of a filling mill at Rowley, Massachusetts. This mill was built "by Mr. Rowley's people, who were the first that set upon making cloth

in this Western World." At the close of the eighteenth century the factory woolen industry was established in the United States. At present there are over a thousand woolen mills and over 80,000 looms, of which number a tenth are used in making carpets and rugs. The number of actively spinning spindles is over four million. Much wool is imported from Australia and Argentina.

The manufacture of woolen cloth in Canada commenced soon after the arrival of the earliest colonists. Intendant Talon reported in 1671 that the colonists were making practically all articles of clothing required. Many of the large woolen mills in Canada to-day are the successors of the small carding plants then operated in connection with a grist-mill or a saw-mill. In the province of Quebec the first power mill was established at l'Acadie in 1827. In the province of Ontario in 1820 the Honorable James Crooks founded a mill near Georgetown.

Wool is woven into two distinct kinds of cloth, one called woolen cloth, and the other worsted. The difference is due to the way the thread, or yarn, is prepared. Each has its advantages. The woolen cloth is closer in texture and warmer, and worsted is finer and more handsome in appearance. In worsted manufacture the three operations of combing, spinning and weaving are carried on in different factories, whereas in woolen manufacture there is no combing, and the spinning and weaving are both carried out in the same factory.

The question is sometimes asked why a woolen garment keeps us warm when a cotton or a linen one does not. There is always a great deal of air between the hairs, or wool-strands, on an animal's back, and the fluffier the wool is, the more air is held by it. Heat finds it very difficult to get across a layer of air, because air is a bad conductor. So whether the wool which holds a layer of air is on the animal's back or on our back in the form of clothes, it keeps the body warm by the way it prevents the heat from passing off into the atmosphere.

As a matter of fact, a woolen garment will keep us cool in summer as well as warm in winter, for just as it prevents the heat of the body from passing out, it prevents the heat of the sun and air from passing in. That is why the ice-man sends his ice through the streets covered with a thick blanket. He thus saves it from being melted by the sun.

Photo, United States Forest Service.

SHEEP GRAZING IN THE SANTA FÉ NATIONAL FOREST

It is not sufficient, however, that a material should prevent heat from passing through it—rubber would do that—but it must be porous so that the outside air and the inside air can mingle to some extent. In this way the perspiration produced when we exert ourselves at work or play evaporates slowly.

In a changeable climate it is important that we wear wool next to our bodies to save us from the sudden chills that are so harmful to health. Let us remember, many of us owe our health to the sheep that supply us with wool.

THE NEXT STORY OF FAMILIAR THINGS IS ON PAGE 5665.

HOW WE GET WOOL

The world's production of wool amounts to over 2,000 million pounds a year, and over a fifth comes from Australia, which possesses nearly eighty million sheep. Here sheep are being rounded up for shearing.

Each sheep averages about eight pounds of wool a year, that is, double the yield obtained forty years ago. The increase is due to scientific methods of selecting and breeding. Here we see a flock after shearing.

DIPPING THE SHEEP

Sheep suffer from a skin disease known as scab. To keep the animals healthy, the Australian Government insists that all sheep shall be dipped twice a year; that is to say, they shall pass through a bath containing a germ-killing liquid.

SHEARING THE WOOL

Sheep are sheared in warm weather so that the loss of their coats will not lead to their catching cold. Here are Australian sheep going into the shearing-sheds. When they pass out they will be without coats.

The men who cut the wool from the sheep's backs are skilful and work with great rapidity, but on the big sheep-stations of Australia machines are used. These work more quickly and cut the wool far more closely.

SORTING THE WOOL

After the wool has been taken from the sheep it is carried to a large shed where men with expert knowledge sort it into various classes according to its weight, texture and quality. Here we see the sorters at work.

When the wool is sorted it is arranged on tables in a salesroom, each lot being marked in readiness for the auctioneer. The buyers inspect the wool before buying. Here the wool is spread out before the sale.

SENDING THE WOOL TO THE SHIPS

A CATTLE TEAM WITH A FINE LOAD GOING TO THE NEAREST RAILWAY

A HEAVY CONSIGNMENT OF WOOL TRAVELING BY HORSE WAGON

A TEAM OF CAMELS TAKING WOOL ACROSS A DESERT AREA

A WOOL TRAIN ARRIVING AT SYDNEY HARBOR WITH BALES READY FOR SHIPMENT

THE WOOL GOES OUT BY SEA AND RIVER

Much of the wool is taken by horse- or ox-wagon to suitable points on the coast, where it is picked up by a schooner that travels round, and, after getting a full load, carries it to a port for transshipment.

Other sheep-stations send their wool to the nearest point on the rivers, where it is collected by large barges carrying 1,600 bales each. This picture shows barges traveling down the Darling River to Sydney.

THE BALES OF WOOL REACH PORT

When the wool collected from the various sheep-stations arrives at the seaport it is placed on board a large steamer and exported to other countries for spinning and weaving into warm garments.

Arriving at the final destination, the bales are unloaded and placed in warehouses, where a sale is held, and here we see the buyers sampling the wool in order to test its texture and quality before the sale begins.

READY FOR THE WEAVER

When the wool reaches the mill it is washed free from grease and other impurities with soap, and here we see it coming from the scouring tanks.

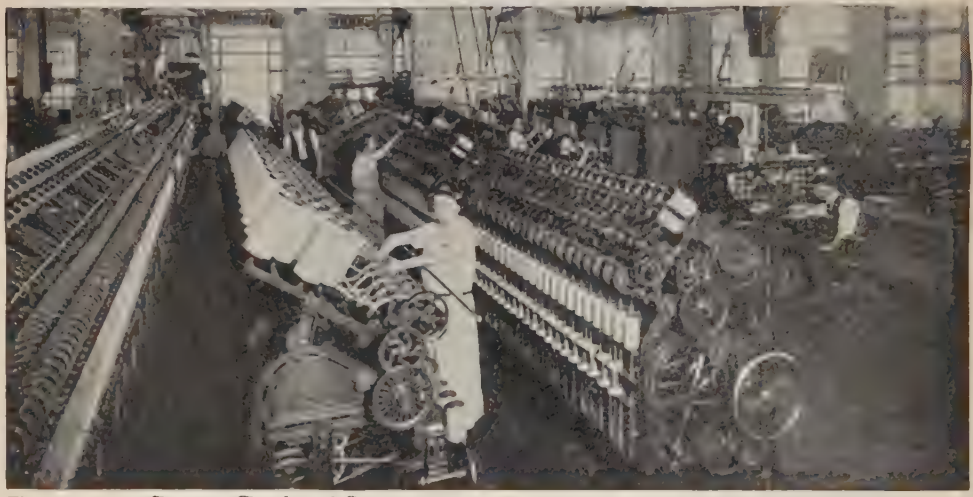
It is then passed through the machine shown in this picture, which dries the wool and removes some of the harshness caused by the process of scouring.

Another machine, known as a willowing machine, then opens out the wool and separates the various locks.

Then the wool is passed through a carding machine, which consists of a number of leather-covered rollers with wire teeth that separate and arrange the fibres.

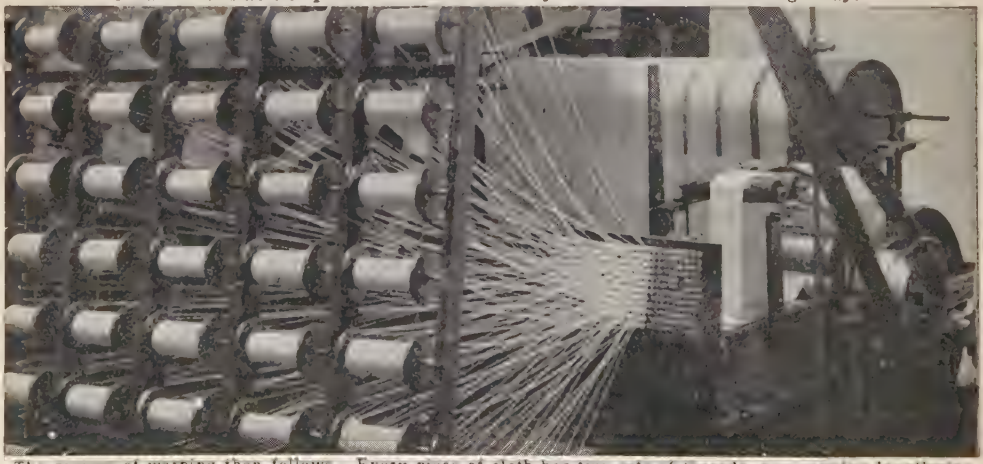
SPINNING RAW WOOL INTO YARN

For the making of worsted cloth the next step is to comb out the wool in the machine shown here, from which the fibres emerge parallel and in the form of a fleecy sliver, or strand, ready for spinning into yarn.



Photo, courtesy Portland Chamber of Commerce.

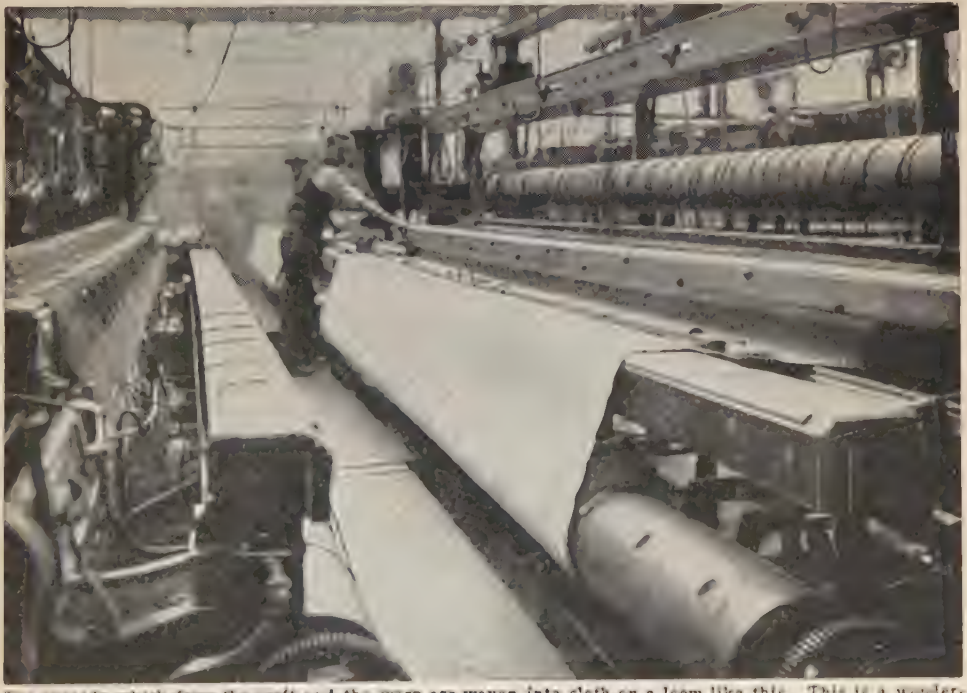
Next the fibres are spun or twisted into yarn in a huge machine with many whirling spindles. The one shown here is able to produce over 340 miles of yarn in the course of a single day.



The process of warping then follows. Every piece of cloth has two sets of threads, one running lengthwise, the warp, and the other crossing these, the weft. Here the warp threads are being arranged for the loom.

WEAVING THE SPUN WOOL

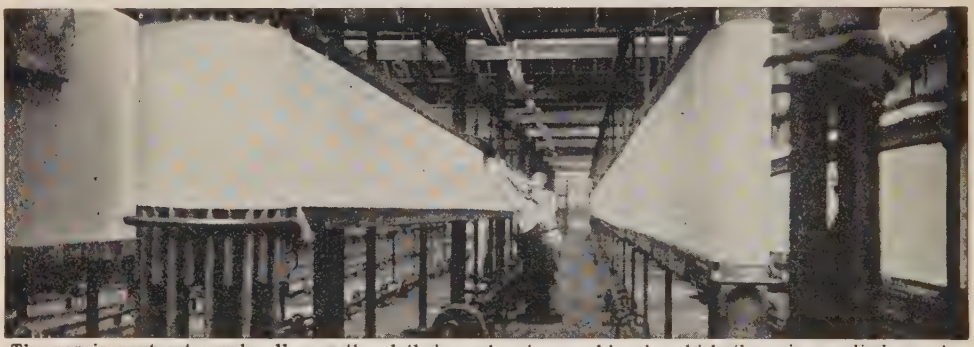
The warp is then wound on to a warp beam, so that each thread will be delivered regularly during weaving. The clusters of threads are attached to hooks, and the threads are held down by a rod.



The threads which form the weft and the warp are woven into cloth on a loom like this. This is a wonderful machine, and produces cloth at a rate that would astonish the primitive weavers of India and Turkey.

THE CLOTH IS READY FOR USE

The cloth is then scoured, or washed, and goes through a process known as "fulling," in which it is saturated with water containing fuller's earth. Then it is passed between rollers and drawn through holes to press the threads tightly together. After that it is dried in a tentering machine and "raised," which means having a nap put on the cloth by rubbing it with teasel-heads.



The nap is next cut evenly all over the cloth in a shearing machine in which there is a cylinder and a number of sharp blades. The machine works something like a lawn-mower. After being pressed to remove creases and steamed to take away the glaze, the cloth is stretched in a drying-room.

Finally the cloth is folded across down its length, and this makes it handier for handling. A disk on the machine marks the length of cloth that has passed through. The cloth is then rolled or folded ready for the shop.

Trading ships in a European river.

TRADE BETWEEN NATIONS

WHEN we were speaking of the meaning of wealth we noticed how large a part is played in human affairs by the division of labor. People devote themselves entirely to particular jobs, so that one man does nothing but make shoes or parts of shoes, and another does nothing but make bicycles or parts of bicycles. A third lays bricks, and a fourth works on a farm.

Trade is a natural result of this division of labor. Robinson Crusoe on his island did everything for himself—at least until he discovered Friday—and therefore trade for him did not exist. If, however, we imagine a hundred people living on an island, we see that as soon as they began to divide their labor among different occupations, the need for exchanges between them would spring up.

One man would make a weapon and exchange it, perhaps, for a fish caught by another, or for some grain grown by a third. That would be a simple exchange of goods—we call it Barter. When a boy changes an old penknife for an apple, that is an act of barter, and in the early days of mankind trade was all done in that way. Afterward, as we shall presently see, Money was invented to help exchange.

It is impossible to exaggerate the importance of trade to mankind, for it takes a thing from where it is made to where it is needed, and until a thing becomes available to a person who needs it, it has not really become useful. It may be said with truth that wealth is matter in the right place, and the matter can be got into the right place only by inventing some means of exchanging the many different things which are made at home and abroad, so that those who need them can get them.

We can remind ourselves how important it is to transfer things from places where they are *not* wanted to places where they *are* wanted by taking the case of common gravel. We find gravel in some districts in almost unlimited quantities, and often it appears to be valueless where it lies. In a place where building is done, however, it is a very important raw material of industry, used with cement in making concrete. Therefore great trouble is taken to dig the gravel in the place where it is not needed and to transport it by road or rail to where building is going on. This trade in gravel changes a useless thing into a very valuable thing.

So, every working day men are busy all over the world producing things which are rapidly transported, by land

or sea, to places where they are needed. Engineers make roads, railways, vehicles, ships and barges to assist transport, and the world presents a picture of mountains of goods of all sorts being carried from place to place to satisfy human needs. Where once a few barbarians doing little or no trade gained a meagre living, great populations exist because of the trade which has been built up during centuries of development.

The need for trade, or exchange, is so great, indeed, that if we were all making things, we should make them in vain. People would simply be piling up goods which would serve no useful purpose. That is why a very large proportion of the population is needed, not to make things, but to carry them, or to deal in them, or to work in some other way, as in a bank, to help trade by providing it with facilities.

THE WORK OF MANY PEOPLE THAT GIVES A THING ITS VALUE

Millions of people have to be employed in making or repairing roads, docks, harbors and railways used in the transportation of goods, and in building, repairing or working in warehouses, stores, shops and offices concerned with the storage and sale of goods. A man working on a railway and helping to take coal from a section where it is plentiful to a city where there is none, is just as much a producer of coal as if he were a miner. If the railwayman did not transport the coal it would be useless for the miner to get it out.

To go a step farther, it would be useless either for the railwayman to carry coal or for the miner to mine it, if offices and stores were not set up to enable people to buy coal when they need it. And, as with coal, so with other things. They have not only to be produced, and carried by sea and land, but they must be stored and sold in convenient markets or shops. The more simple we can make the exchanging of goods, the better it is for everyone. If a commodity has to pass through many hands before reaching its final destination, the cost to the consumer would be proportionately high.

THE MILLIONS OF WORKERS AND HOW THEY EARN THEIR LIVING

In our country about half of the population over ten years of age is "gainfully employed." The other half includes the women at home who do not work for wages, young people in school, people unable to work because of old age or illness, the small class who do not work, and a few others. Of these millions "gainfully employed," part are engaged in producing things. That is to say, they are either miners or quarrymen getting out coal, ores and stone; or agricultural workers producing food; or fishermen; or industrial workers producing metals, engines, machinery, tools, textiles, earthenware, rubber goods, leather and leather goods, vehicles, houses and other articles. The other part of this class of the population is engaged either in governing or in seeing that the law is obeyed; or in transporting things by road, rail, river, canal or sea; or in wholesale or retail buying or selling, or in banking and insurance, or in teaching, or in caring for our health, or in amusing us in theatres and moving-picture houses.

Sometimes those who actually make or grow things are called the producers, but everyone who does useful service is really a producer, whether or not he actually works in agriculture or manufacturing, because all useful work helps production. As we have seen, it would be useless for the miner to get out coal if the railway did not transport it or the merchant did not deal in it; and the man who brings coal to our cellar is as much a producer as the man who uses the pick in the mine.

It is equally true that if school teachers did not teach, if doctors did not attend to our health, and dentists to our teeth, if wholesale merchants did not buy and sell in big quantities, and if retail shops did not keep convenient stores, production would be in vain.

THOSE WHO HELP PRODUCTION WITHOUT ACTUALLY MAKING THINGS

Sometimes people who trade in goods are called *middlemen,* as if it were a reproach to deal rather than to make. The reproach is not deserved if the middleman's business is well organized, and if he deals fairly. The work of merchants, agents, brokers, bankers, insurance men and other commercial workers is indispensable *under present conditions,* because it provides goods at the points where they are needed, and gives us the *useful distribution of articles after they are made.*

The banker helps buyers and sellers, and so takes a real part in production. The lawyer who interprets the law, or

settles a dispute, either by private negotiation or by conducting a lawsuit, is equally indispensable in the present state of society. The actor or singer may also claim to help in production because he amuses and cheers the life of his fellowmen and helps them to work.

It is true, however, that better organization could reduce the number of middlemen, and so help us to obtain a better production of commodities.

No small part of the wealth of a modern country arises from successful trading in commodities which it does not itself produce. Great Britain, for example, has become the greatest market in the world for the productions of many foreign countries, such as wool, tea, cocoa, rice, spices, tobacco, cotton, hemp, jute, hides, india-rubber and ivory. The trade in such things as these is very profitable to shipowners, merchants and warehousemen, and gives employment to many thousands of workers.

The great importance to us of foreign trade

Some people think home trade is very much more important than foreign trade carried on by means of thousands of ships. Domestic trade is important, but we shall soon see that foreign trade is vital to our prosperity.

No nation now existing can produce everything it needs, and, on the other hand, it may have more of other things than it can use profitably. Canada has immense forests and can spare wood-pulp and paper to the United States and Europe, which need them. Both Canada and the United States raise more wheat and cattle than they can eat, and can sell some to hungry Europe. The United States sells raw cotton to the world.

On the other hand, though the United States makes more motor cars than all the rest of the world, it cannot grow rubber and without rubber the motor trade would decay. Neither Canada nor the United States can grow coffee, tea, silk, or spices with profit, and neither produces enough wool for its factories, nor enough sugar for its needs. If these countries could not get these products from elsewhere, thousands of people would be thrown out of employment and millions more would be uncomfortable.

The United States produces more oil than it can use, while Canada has not enough; but Canada is the chief producer of nickel, which the United States needs. The latter can send oranges, lemons and grapefruit to Canada. Some of the furs which Canada does not need will more than pay for them. We could go on for pages showing how the surplus in one country is sent to another, and in exchange necessary articles are received. No nation can live without the products of others.

When the manner of life is simple and the wants of the people are few, a group of people can live almost without intercourse with other groups, but their state of civilization will not be high. One of the marks of an advancing civilization is the great increase both in the number and kinds of things desired. The savage wants only a few things, while the civilized man wants many.

What would happen if foreign trade were shut off

If high walls were built around all countries, shutting off all communication with other nations, the level of comfort and civilization would go down. Probably the United States would be better off than any other nation because of the wide extent of territory and the varieties of soil and climate, but the people of the United States would be very uncomfortable, and thousands of factories would close.

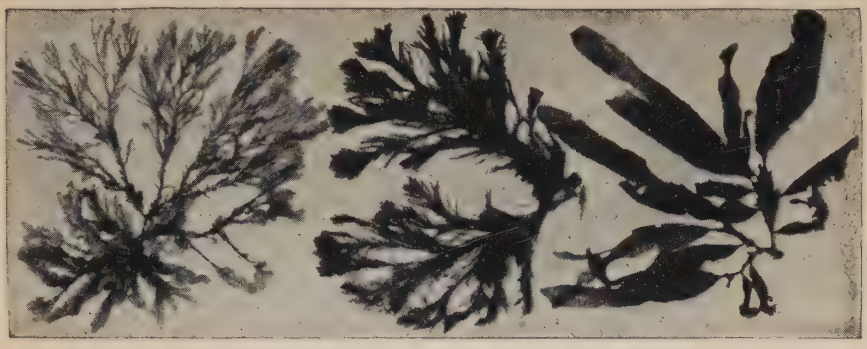
Where a country depends chiefly upon manufacturing and trade the conditions would be much worse. Great Britain is a small country with a large population for its size. It produces hardly a third of the food it eats, but buys food with coal from its mines, or with manufactured articles. Probably, if an end should be put to foreign trade, a greater quantity of food could be raised than at present, but not enough to support half the people who now live there. They would be forced to emigrate or starve.

Canada and the United States, on the other hand, can grow more of the most important articles of food than they need, though without foreign trade they would have to do without some which the people think necessary. If some factories could not get the necessary raw material from abroad they would shut down, and the people could not buy food from the farmers, who even now must send much of their crops abroad. So you see that what we call the "standard of living" would be almost sure to fall.

THE NEXT STORY OF OUR OWN LIFE IS ON PAGE 5679.

FERNS AND FEATHERS OF THE SEA

We only realize the beauty and delicacy of the various seaweeds that are found in the waters round our coasts when we collect them and, after pressing the specimens, arrange them on sheets of paper as shown here. All the "ferns and feathers of the sea" on this page are common specimens found round our coasts.



A COLLECTION OF SEAWEEDS

THERE are few natural objects that provide so artistic and graceful a collection as seaweeds; and as these are to be found in abundance and variety on all our coasts, it is within every boy's and girl's power to make a collection, for we all go to the seashore at one time or another. Butterflies and moths may present more color, and flowers may be more familiar to the eye, but for real artistic effect a collection of seaweeds is second to neither of these.

Some of the seaweeds found in water have stems of enormous length. One which grows in the Pacific Ocean has a stem over 300 feet long, and another sometimes reaches the enormous length of 1,500 feet. But the seaweeds usually found around our coasts are mostly small, and very suitable for mounting on cards.

Of course seaweeds have their commercial uses. One kind gathered on the coasts of Europe is used to make manure for the land. This was formerly much more used than it is now. Other kinds are used as food for cattle, and one or two varieties are even eaten for human food. Then, too, seaweeds contain much iodine, which is sometimes extracted for medical uses. It is not for these purposes, however, that we shall collect seaweeds, but rather to provide an interesting hobby, and to give us a really attractive little marine museum that can be packed in a small space.

For the collecting of seaweeds a very inexpensive equipment is needed. We should have a stick with a hooked handle for drawing ashore any weeds that may be floating a little distance out from the water's edge, a good knife with a strong blade for cutting pieces of the stouter weeds from the main plant, and a waterproof bag or a fishing-basket in which we can carry home our specimens.

The seaweeds are to be found at high-water mark, where many specimens that have been torn off by the waves are left stranded, and they are also found at low-water mark. It is the coarser and bigger weeds that are found detached in this way, but in the rocky pools many of the finer and more delicate seaweeds grow in abundance, and these, although they may not look very attractive in the water, are beautiful when dried and mounted.

As beginners in the art of collecting seaweeds, we shall get all the specimens we need on the beach and among the rocks. The weeds very often have sand and other matter sticking to them, and this may be roughly rinsed off in the pools among the rocks.

When we get our specimens home we should take a large basinful of sea-water, and empty them into this. It is essential that we should use sea-water, as some of the seaweeds begin to decompose if placed in fresh water. If a large basin is not available, a small bath can be used, but the basin is more suitable because we are able to see the specimens that are in it quite clearly.

After washing the seaweeds by shaking them about in the water we should place them in another vessel containing sea-water that has been filtered through a piece of muslin or toweling. Here, again, a white dish is the best kind of receptacle that can be used, and it should be rather larger than the sheets of paper upon which we intend to mount our specimens. Cartridge or any similar thick paper is suitable, and we may use two or three sizes for the different specimens. Sizes suitable for our purpose are: 5 inches by 3½ inches, 8 inches by 6 inches, and 12 inches by 8 inches. It is well to have a sheet of perforated zinc, as this greatly helps in the mounting of the specimens. We place a sheet of paper upon the zinc, which may have one of its edges turned up to prevent the paper from slipping off, and then we pass these into the dish,

beneath the floating specimen that we wish to mount. While the seaweed is still in the water we remove any lingering impurities, such as grains of sand, with a camel's-hair brush, and then raising our zinc and paper so that the specimen rests upon the paper, though it is still in the water, we arrange it neatly and artistically by means of the brush. If there are any ugly pieces or ends that spoil the general outline of the specimen, these may be snipped off under water with scissors.

When the specimen is nicely arranged on the paper we raise the zinc gently out of the water, taking care not to disarrange it. The water runs off the paper and through the holes in the zinc. Now slide the sheet of mounting-paper on which the specimen is resting off the zinc on to a piece of cloth that has previously been laid on some sheets of thick blotting-paper.

MOUNTING THE SEAWEEDS

With a perfectly clean sponge of fine texture mop up the water that is lying on the paper, taking care, however, not to touch or disturb the specimen in any way. Then lay over the paper and specimen another clean smooth piece of cloth, and on top of this several sheets of blotting-paper. The whole must then be put into a press, care being taken not to press too hard. If a press is not available, use large, heavy books, laying them on evenly and carefully. After 2 or 3 hours the blotting-paper should be removed and fresh paper put in its place, but do not remove the cloth. At intervals of 12 or 15 hours this process should be repeated, and at the end of 4 days the cloth may be removed and the seaweed itself transferred to dry paper, and, if necessary, pressed as before.

In most cases it will be found that the specimen will adhere to the mounting-paper under pressure without any adhesive material being necessary. Should it be necessary, however, to stick the seaweed down, the following is an excellent method: Boil some milk, and remove the skin that forms on the top. Then placing the specimen upon a piece of smooth cloth, with a sponge or soft rag moisten the paper with the milk and lay the sheet carefully upon the weed, which will adhere to it. The sheet should then be put under pressure as before.

HOW TO MOUNT THICK SEAWEEDS

The thicker kinds of seaweeds, like bladder-wrack and its relations, should be washed in fresh water to remove the salt, and may then be dried between towels and pressed in the manner stated above. To affix these to the mounting-sheets a little gum may be used. If it is not convenient to mount these coarser weeds at once, we may allow them to dry in the air; then when we are ready to mount we should soak them in boiling water for about 20 minutes. This removes the salt and other impurities, and afterward they may be washed in fresh water, and pressed as described. The sticky kinds of seaweeds, after being arranged on paper, should be allowed to dry in the air before being pressed, or they will adhere to the cloth and be spoiled.

All specimens should have written below them the time and place where they were gathered, and their names and families, if possible. It will take time to identify all our specimens, but this may be done by consulting a book upon seaweeds with colored plates, such as is to be found in most public libraries. Visits to museums are a great help.

CATALOGUING THE SEAWEEDS

Like land plants, the great family to which the seaweeds belong is arranged in groups, and many of the species can be distinguished from one another only by close examination. However, this work of identifying what we have collected and mounted is interesting, and of course a named collection is infinitely more valuable and creditable than a mere collection of odds and ends, the names of which are unknown. It is impossible here to give any account of the various species of seaweeds, but we shall find it helpful to know that there are three main groups—the green, the red and the olive-colored.

The first group consists principally of thread-like or net-like weeds, and most of its varieties are found not in the sea, but in fresh water.

The weeds belonging to the second group are exclusively marine. They are, as the name implies, nearly always red in color and are very light and delicate and frequently almost transparent. Some are like moss in appearance, others resemble ferns, and others look something like coral. They are the most attractive of all the seaweeds, from the collector's point of view, and many of those in the picture on page 5592 belong to this group.

The third group is also exclusively marine. The weeds belonging to it are generally large and coarse, and in foreign waters are almost like small floating trees. The very common bladder-wrack of our coasts—that coarse, brown weed with fronds and air-vessels that is found everywhere, and dries black—grows sometimes to a height of 10 or 11 feet, and the clusters are often 12 feet or more in circumference. Some weeds of this group are small and beautiful, while others are flat.

There is a pretty scarlet seaweed which is found usually in June and July; its shape resembles that of the hart's-tongue fern, and it still retains its color after it has been dried. Another familiar variety is that known as sea-lettuce, which is a very delicate shade of green. The common coralline has a purple tinge when growing, but turns white when dried.

HOW TO KEEP THE SPECIMENS

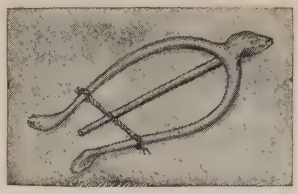
When we have collected a large number of seaweeds we may arrange our specimens on sheets of paper as described above, so that they will present somewhat the appearance shown on page 5592. The next question that arises is where and how we shall keep these sheets.

Instead of a portfolio we can use a box, especially if we are collecting several specimens of each kind of seaweed. Whichever plan we follow the great thing to observe is neatness and order in arrangement.

If we want to find botanical descriptions of the seaweeds we collect, we can find them under the classification of Algæ, for the Latin word *alga* seems to mean the same thing as our English *seaweed*. "Seaware" is algæ used for fertilizing, and "seawrack" is grass-like algæ.

A JUMPING FROG MADE FROM A WISHBONE

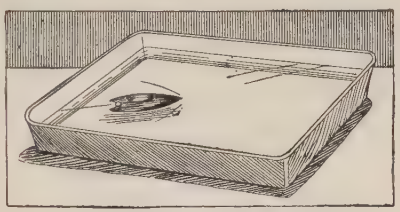
WE all have poultry at Christmas-time, and there are plenty of wishbones to be had. It is quite easy to make a jumping frog from one of these. Take the wishbone, and first of all thoroughly clean it, leaving it a day or two before using. Then take a piece of strong, thin string, and, doubling it, tie it securely to the two arms of the bone about an inch from the ends, as shown in the picture. Now take a strip of wood a little shorter than the bone, and about half an inch from one end cut a notch right round. Slip the stick halfway through the doubled string, midway between the two arms of the bone, and turn the wood round and round until the string is twisted up and shows a strong resistance. Then pull the stick through until the string clings round the notch. Cut out of thin cardboard the rough resemblance of a frog, and stick this with glue or mucilage to the top of the wishbone. All that is now needed is a touch of glue on the under-side of the bone where the end of the stick will touch it when it is pulled over as in the picture. Having pulled the stick over, lay the bone, or frog, on a table, and in a moment or two the glue will cease to hold, and the springiness of the twisted string will cause the bone to jump quite a distance. A few experiments will soon show us how tightly to wind the string.



A LITTLE BOAT THAT MOVES IN THE WATER

IT is easy to make a simple little boat that will move along in the water without mechanical appliances of any kind. We cut out of a thin piece of tinfoil a shape something like a boat, about 2 inches in length, with a triangular nick at the end. The tinfoil must, of course, be very thin. Then we place this gently on the surface of the water so that it will float.

Now let us take a piece of camphor, such as can be bought at any drug store, and from this cut off with a penknife a little piece about the size of a small pea. We place this upon the end of the tinfoil boat at the angle of the nick, so that while resting on the boat it also just touches the water. In a moment or two the boat will begin to move, and will continue to do so as long as the camphor touches the water. By cutting the tinfoil a little curved or like a horseshoe in shape we shall have a boat that will travel round and round in a circular dish or basin. A skillful boy will be able, with a small piece of very thin wire and a fragment of tissue-paper, to erect a mast in the boat, with a flag at the top.



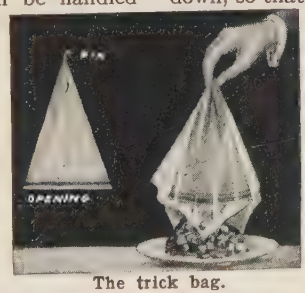
The little boat driven by camphor.

A GOOD CONJURING TRICK WITH NUTS

THERE is an excellent conjuring trick that can be performed with very little preparation or apparatus, and if it is practiced once or twice until skill is acquired, it will greatly mystify the spectators.

We hand round for the inspection of the audience an empty dessert plate and a clean pocket-handkerchief. These can be handled by anyone who likes to prove that they have no secret pockets or recesses. We now place the empty plate on the table, spread over it the pocket-handkerchief, and then, after making a few mysterious passes with the hand or a wand, we raise the handkerchief and shake out of it upon the plate a number of candies or nuts.

This is the explanation of the trick. We make a small triangular bag, as shown in the first picture, by sewing together two triangular pieces of linen or calico, and in the two hems on each side of the opening we sew straight pieces of watch-spring, taking care that in each case the spring goes the whole length of the hem. The springs will keep the bag closed unless force is used. A pin, bent to a hook, is put through the apex of the bag.



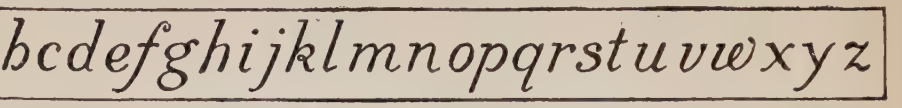
The trick bag.

Nuts or candies are now placed in the bag, and the spring closes the mouth, so that when the bag is suspended they will not fall out. Having prepared the bag in this way, we hang it by the hooked pin on the side of the table that is away from the spectators, this being done, of course, in advance, before they sit down, so that they know nothing about it.

After showing the empty plate to the audience, we place it on the table near the edge where the bag is suspended, and in spreading the handkerchief over it we see that part of it hangs over the edge of the table where the hooked pin is. Then in picking up the handkerchief we dexterously pick up with it the bag, the handkerchief falling all round so as to hide the bag. The rest of the trick is simple. We shake the handkerchief with a few vigorous jerks, and the impact of the nuts or candies parts the springs, which are not very stiff, and allows the objects to fall out on the plate. The bag can then be skillfully dropped behind the table, which should, of course, have a thick cloth upon it, reaching down to the floor, so as to effectively hide the back. There are few conjuring tricks so easy to perform.

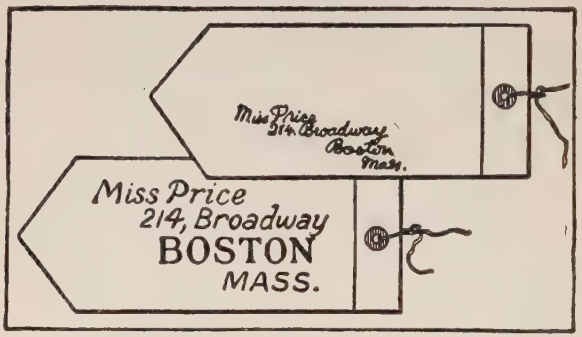
PRINTING AND FANCY LETTERING

THE art of lettering, by which we mean the ability to make ornamental letters as apart from those of ordinary handwriting, is a very useful one. People sometimes call them "printed" letters, because they are like those used in books—and usually found on the heading and on title-pages. We must have often noticed these letters, and perhaps even thought how well they were arranged; but it may not have occurred to us that they all have to be made by a pen in someone's hand before the printing machine can produce them so neatly.



1. An excellent type of small lettering, which may be printed with a pen or brush without difficulty.

Our artists are always designing new and ornamental shapes and ways of making the alphabet, and when we know something about this very interesting art, we shall look with new interest at the title-pages of good books, and observe on many other things—such as statuary, monuments, buildings, tablets, and so on—how very beautiful and effective the letters of our language can be drawn.



2. A label written in the ordinary way and a label printed.

Let us think of a few of the things which seem to call for "printed" letters rather than "written" ones.

To begin with, quite ordinary household things like addresses on parcels and baggage are much clearer if done in neat, plain capitals, as in picture 2, and so are more likely to be correctly read by busy porters and postmen, and are less likely to get lost.

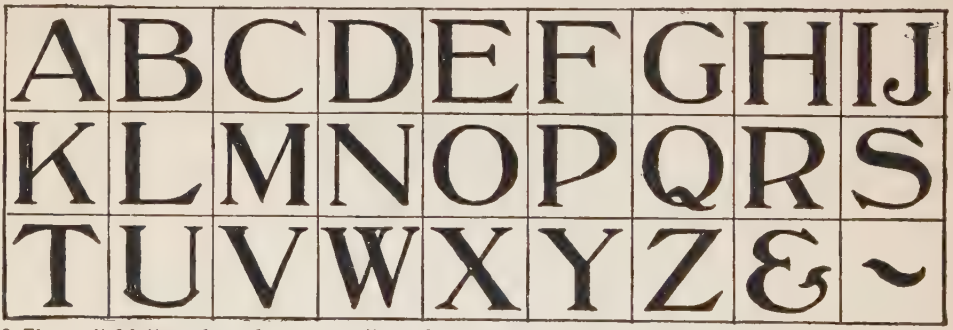
Then there are lists of things such as those we pin up inside the doors of the bookcase or music cabinet or storeroom; albums containing collections of things such as stamps, papers, or put clear names on our maps—we shall find lettering most useful.

Then there are clothes to be marked with marking-ink, chests of small drawers needing labels of contents, handkerchief initials, Christmas cards, the outer covers of music and books, embroidery, wood-carving, and many other things where letters play an important part.

Here are a few simple rules in easy lettering, and two alphabets—as we see in pictures 1 and 3—which we must learn by copying them out several times as carefully as possible. With these two styles we shall find ourselves able to letter quite satisfactorily for ordinary purposes.

1. Do not mix up different kinds of letters in one word.

2. Remember that the rule "thin up-strokes and thick down-strokes" must be applied to printed capitals as well as to copybook handwriting. Look at picture 3.



3. The capital letters shown here are easily made, and, as can be seen, they may be arranged in squares.

3. Beware of cutting up a word into meaningless syllables.

4. Make bold letters, and give full prominence to each part.

5. Do not crowd the letters together, and make them quite straight on a line.

6. A useful point to remember when beginning is that each capital can be fitted into a square, except, of course, the letters I and J, which fill one square between them.

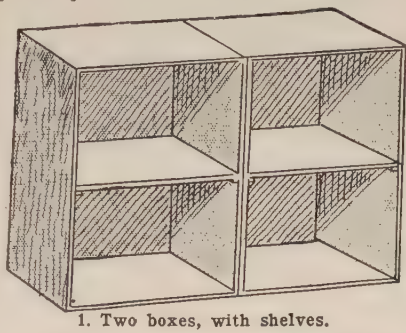
The letters in picture 3 have been done with a brush dipped in ink, which, by the way, is a better thing to use than a steel nib when brown paper or any other rough substance has to be written upon. A quill pen will make excellent letters also.

Let us look at the pictures of the two baggage labels on page 5596. Which is the clearer and more easily read? The bottom one, of course, and yet it took but very little longer to do than the other. We must always remember to give prominence to the most important word by writing it in the largest letters, or using another set of letters, as we see has been done on the second label. This rule applies to everything—not only to addresses. This often prevents a delay in delivery.

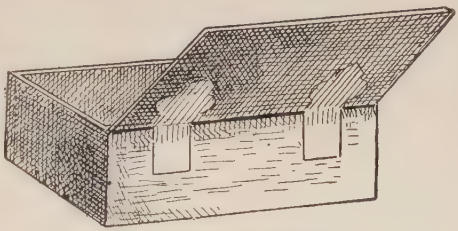
At first we shall need a pencil-line as a guide to keep the letters straight, but when we have become more accustomed to the work, we shall be able to do without this, just as we do without it in ordinary writing.

A CABINET MADE FROM CIGAR BOXES

WITH three cigar boxes, and close attention to the instructions given in this article, we can make a very handy little wall cabinet that will serve many useful purposes. Two of the cigar boxes should be of similar size, but the third need not be quite the same size, as it is going to be pulled to pieces and the wood of it used. First we must take off all the paper on the boxes. This can very easily be done by using a wet sponge and letting the boxes stand for several minutes before removing the paper. When we have removed all the paper, we must be sure to allow the boxes to dry gradually, and not seek to hasten the process by putting them in front of the fire, which would probably crack the wood. The third box we take apart, in doing so endeavoring to be as careful as possible not to break the pieces, and keeping the nails, which we shall want to use presently.



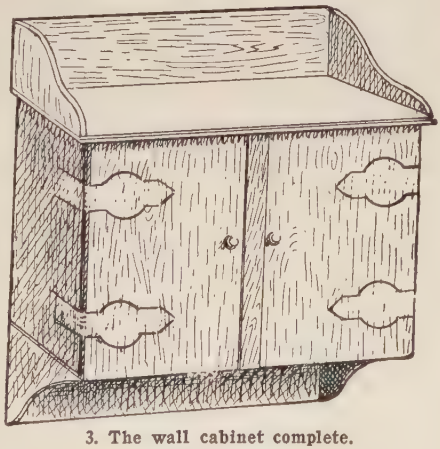
1. Two boxes, with shelves.



2. One box, showing hinges.

Most cigar boxes have a brand-mark which is burned in on the outside of the lid, so in order to get rid of this we turn the lids, making the inside what was formerly the outside.

After we have cut two strips of wood from the cigar box that we have taken to pieces, and have made them the proper size, we then fit them into the cigar boxes, as is shown in picture 1, to do duty as shelves. Two nails from each side through the two sides of the boxes will keep them in position. Now we take two pieces of linen or cotton, cut them to some ornamental shape, and glue them to the lid and to the back of the box, so as to make hinges, as seen in picture 2. Then we glue the front sides of the two boxes face to face, and this will give us a two-compartment cabinet, with a shelf in the middle of each compartment, as seen in picture 1. With two more pieces of the broken box we make two slips—one to be placed right along the top of our cabinet outside and the other to go right along the bottom. Picture 3 shows that the piece on top and the piece on the bottom are similar in pattern. Both these pieces should be glued on, and a few nails will help them also, but we must take care not to split the wood. Now by putting on a long piece top and bottom, supported by two brackets, which we cut from the third box, we can give our cigar-box cabinet both strength and ornamentation. All we have still to do is to cut a narrow strip of wood about half an inch wide and the length of the doors.



3. The wall cabinet complete.

After rounding this on two of its corners, we glue it to the edge of one of the doors, so that it will come over the edge of the other door, as seen in picture 3. Two tiny brass knobs, one for each lid near its edge, will complete the cabinet, which we may hang in our bedrooms, and which we shall find convenient for museum specimens, for tiny bottles, for seeds, and for many other things which boys and girls may wish to treasure and which ought to be kept in proper order. Of course we can decorate this cabinet with stenciling to make it more ornamental.

PROVERB GAMES FOR THE FIRESIDE

THERE are a number of interesting games with proverbs that will give much fun at an evening party or at any time that a number of friends are together. It is always a good test of memory and quickness to answer at once in games in which the task set is for one player to guess a proverb that has been decided upon by the other members of the party who are present.

CRYING PROVERBS

THE game of Crying Proverbs is played in the following way: One player retires from the room, while the others choose some proverb, and each takes one word of the sentence. Then the player outside comes in, and, at a signal, all the others call out their words at one moment. From this hubbub of mixed sounds the player from outside has to try to learn the proverb that has been selected. If at first he does not succeed, the proverb can be cried out again and again, until he does guess it or gives up in despair. This is a noisy game, but a great laughter-maker.

Of course there are a number of points to be considered that add to the difficulty and consequently to the amusement of the game. It is better not to choose a proverb that has in it some distinctive key-word, for if the guesser hears this he is likely to answer correctly at once. For example, the word "broth" would at once suggest: "Too many cooks spoil the broth." Then it is wise to choose a fairly long proverb, so as to have as many players as possible calling out the words, rendering the sounds the more confusing.

ACTING PROVERBS

IN this game each player takes it in turn to be the actor, and he has to go through some actions which will suggest a proverb. The other players watch him, and try, from what they see him do, to guess his proverb. For instance, the action of sewing would suggest: "A stitch in time saves nine." Carrying a cup very carefully across a room would mean: "A full cup must be carried steadily." A pebble rolled along on the ground, and then picked up and looked at as though something were expected to be found upon it, would be: "A rolling stone gathers no moss." There is good scope for ingenuity here.

PROVERB GAMES ON PAPER

THERE are several proverb games that are played with pencil and paper. A good game to play round the fire is for each player to write upon a slip of paper the vowels only of some popular and well-known proverb. The papers are then exchanged, and everybody has to try to discover the proverb of which he has only the vowels. Here is an example: *i e a o a a a e a a i.* This looks rather formidable, but it is really the skeleton of the proverb: "Give a dog a bad name and hang him." If this game is thought too difficult, we may play a similar game by taking well-known proverbs and omitting every other letter or every third letter.

Another similar game is to break up a short proverb into its letters and arrange these in alphabetical order, thus: *d d e e e e c g i n n n o o s s w w.* If it is considered too difficult, one word may be given of the proverb as a key. For instance, in this example the word "weeds" might be given. The whole proverb is: "Weeds need no sowing."

At a proverb party a good puzzle is this: *We is do.* This represents a well-known proverb in an abbreviated form. It will be a clever boy or girl who guesses the solution without having heard it before. The proverb represented is: "Well begun is half done."

In all these proverb games it is essential that the proverbs chosen should be really popular ones that are quite well known to most people. It is astonishing how many of these there are to draw from.

SOLUTIONS TO THE PUZZLE RHYMES ON PAGE 5511

SOME puzzle rhymes are given on page 5511, to which these are the answers.

The word referred to in the first verse is *cataract*, which is certainly a fine sight when found in the course of a river like the Nile, but is anything but pleasant as a defect of sight. The solution of the next rhyming puzzle is *anemone*, an m on e.

Dr. Whewell's strange-looking puzzle can be solved by remembering that O is a cipher. The lines can be read like this:

> You sigh for a cipher, O I sigh for you,
> Sigh for no cipher, O sigh for me too.
> You sigh for a cipher, I decipher so,
> I sigh for no cipher, I sigh for you too!

Of the buried names, the animals in the first verse are: chamois, buffalo, heifer and leopard; the eight British poets in the next verse are: Gray, Moore, Byron, Pope, Dryden, Gay, Keats and Hemans; and the four fruits in the last verse are: orange, pear, date and banana.

The solution of the first arithmetical puzzle is written thus, $\frac{99}{9} = 16$. Two of the three nines are put upside down. In the next puzzle the answer can be given thus:

> Forty-five years I had seen,
> When my bride was but fifteen.

This, it will be found, answers the requirements of the puzzle rhyme. In the third arithmetical problem the solution is worked out in this way. The two nines are written thus: IX NINE. Then S, which is a third of SIX, is written at the beginning and at the end, and we have SIX NINES, which are equal to 54. In the next puzzle the ages of the father and son are 42 and 14.

The answer to the first riddle in rhyme is: *Poe, poet, poetry.* The *t* and *try* are added to the name of the American poet *Poe.* The thing Often talked of, never seen, and so on, is To-morrow.

The solutions of the charades are *ox*, ox; *co, nun, drum*, conundrum; and *wel, come*, welcome.

WOUNDED ARTERIES AND VEINS

A SIXTH LESSON IN FIRST AID TO THE INJURED

CONTINUED FROM 5001

WE already know the positions of the principal arteries of the body, and we also know the general way of treating hemorrhage, as excessive bleeding is called. We are now going to learn how to stop bleeding from the different parts of the body. But we must have before us the diagram that we studied in an earlier lesson, showing the arteries of the body and the pressure-points, or spots upon which we press to stop bleeding. That is on page 5001.

First of all there are the arteries of the head and face. When the temporal artery, which can be felt pulsating in front of the upper part of the ear, is wounded we can stop the bleeding by pressing against the bony prominence just in front of the ear.

1. Pressing a head artery.

If the occipital artery, which is the artery that carries the blood to the back part of the head, is wounded, we should press at a point immediately below the wound, as shown in picture 1. Bleeding from the facial artery is arrested by pressing at a point about an inch in front of the angle of the lower jaw. To do this we put the hand round the chin. Another method is to grip the cheek tightly between the thumb and forefinger, by placing the finger inside the mouth and pressing with the thumb outside.

An injury to the carotid arteries, which pass up each side of the windpipe, is very serious indeed, and pressure must be applied at once and continued by relays of helpers till the doctor arrives. We press the injured artery with all our strength downward and backward against the spine, taking care to avoid pressing against the windpipe. It is of no use trying to put on a compress. Such an attempt is almost certain to result in the patient bleeding to death.

2. Pressing the carotid artery.

The only method is to press the artery with the thumb, as is shown in picture 2, using all our strength. If one thumb gets tired, we can let someone else take a turn, or, if there is no other helper, we can use the other thumb while we rest the first one.

In the case of a wound of the forehead or scalp a small, firm pad should be applied on the place from which the blood flows, and this pad can be secured in position with a narrow bandage, the middle of the bandage being placed over the pad and the ends carried round and tied tightly above the pad. After the head and face we come to the upper limbs, and first of all there is the subclavian artery, which can be felt pulsating by the collar-bone, as we already know.

When this artery is injured we should bare the patient's neck and upper chest, place his arm against the body, and press down the shoulder, making him lean his head toward the wounded side. Then grasping the neck, in the manner shown in picture 3, we press downward and backward over the centre of the collar-bone and against the first rib.

The axillary artery, which is a continuation of the subclavian, can be felt throbbing in the armpit. The pressure, in case of injury, must be applied high up in the armpit against the upper part of the humerus, but it is difficult to apply pressure with the fingers or thumb when this artery is injured.

The best method of applying this pressure is to make a very hard pad, nearly the thickness of the wrist, place it in the armpit, and then tie it in position with a narrow bandage. We place the centre of the bandage against the pad, cross it on the shoulder, and then take the ends across the chest and back, and tie tightly under the opposite armpit, seeing, of course, that the pad remains exactly in its correct position and does not slip. The arm should be placed by the side with the forearm along in front of the body, and held in this position with a broad bandage, as may be seen in picture 4.

The brachial artery is a continuation of the axilliary, and runs down the arm on the inner side. When this is wounded the arm should be extended at right angles to the body, and we should grip the biceps muscle, pulling it aside and pressing down deeply with the tips of the fingers against the shaft of the humerus. Another way of stopping bleeding from the brachial artery is by the placing of a pad composed of a stone wrapped up in a folded handkerchief just inside the bend of the elbow, and doubling the forearm over the upper arm and tying it there with a bandage.

3. Pressing the subclavian artery.

Below the elbow the brachial artery divides into the radial and ulnar arteries, and when either of these arteries is injured, firm pressure has to be speedily applied at the wrist. This may be done with the fingers, or we can use a cork which has been cut in halves, placing one half on the radial artery and the other half on the ulnar, and tying them lightly in position with a narrow bandage.

Sometimes the palm of the hand is seriously injured. To stop the bleeding here it is necessary to make the patient lie down, raise the injured hand and arm, and after the palm has been carefully cleansed we make him grasp a firm pad, which is bandaged in position in the following manner: We spread out a triangular

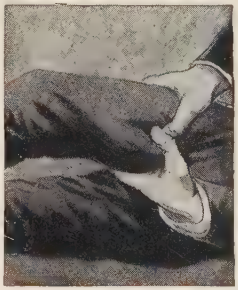
bandage, lay the back of the patient's hand in the centre, bring the point over the fingers and the wrist, pass the two ends of the bandage over the wrist, and cross back over the fingers. This crossing is done twice, and then we tie the ends tightly over the knuckles.

We next come to the arteries of the lower limbs. The femoral artery, which can be felt pulsating in the groin, runs from the thigh to the back of the knee, where it becomes the popliteal artery. In case of injury to the femoral artery pressure is applied at the groin. The first thing to do is to lay the patient down, with the foot of the injured limb raised high. We then grasp the thigh with both hands and place the thumbs, one over the other, on the pressure-point above the wound, as shown in picture 5. Then we press against the brim of the pelvis. A wound of the femoral artery is an extremely serious injury, more especially if it be on the upper part, and the pressure here must on no account be slackened. When one helper is tired, another must take his place without any interval, putting his thumbs over those of the first helper, who then slips his away. No time must be wasted in removing clothes; the pressure must be applied immediately. Minutes count in this.

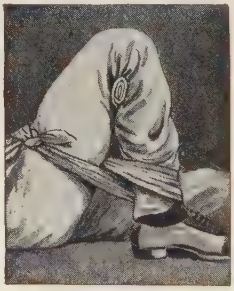
4. How to stop bleeding of the armpit.

If the wound of the femoral artery is in the lower part of the thigh, a tourniquet may be used, and we already know how to make one from a pocket-handkerchief and a stick; the pad should be made of a stone or any similar hard object available, and should be about the size of a tennis ball.

Bleeding from the popliteal artery, at the back of the knee, can be arrested by placing a pad approximately the size of a tennis ball in the bend of the knee, and tying the leg back with a bandage in the manner shown well in picture 6. Should there be any difficulty in getting a pad, the trouser may be utilized by rolling it up to the knee and using it instead of a pad. Should such means fail to arrest the bleeding, a tourniquet must be applied to the artery at the thigh.



5. Stopping bleeding of the thigh.



6. A pad fixed at the back of the knee.

For wounds to the tibial arteries of the lower leg we find it necessary to use a pad and bandage. In case of injury to the foot, with bleeding, it is very important that the wound should be carefully cleansed, and all foreign substances, like pieces of glass, removed. Pressure can be applied with a pad and bandage.

Something must be said about methods adopted for stopping bleeding from a vein. Although in a general way not regarded as so dangerous as arterial bleeding, venous bleeding may be fatal when large veins, such as the jugular vein, which runs in the neck, are badly injured. We have already learned how to distinguish venous bleeding by its dark red color and slow, continuous stream. In this case the patient must be laid down and the injured part raised as high as possible. All light garments on the heart side of the wound should be gently removed, and pressure applied with the thumbs, or with pad and bandage in the same manner as in arterial bleeding. We must take care, however, in these cases of bleeding from a vein to press on the side of the wound farthest from the heart.

Internal bleeding may be detected by loss of strength, faintness, difficulty in breathing, a weak pulse, pale face and lips, a gasping for air, and very often total unconsciousness. It is essential that the patient be laid down, surrounded by plenty of air, and fanned. All tight clothing round the neck must be loosened, cold water sprinkled on the face and put to the lips for drinking, and smelling-salts held to the nose.

For bleeding from the nose the treatment is to set the patient near an open window, with his head slightly tilted back and his hands raised above the head. Tight clothing round the neck must be at once loosened, something cold, such as ice or a door-key, held over the nose and at the back of the neck, and if this does not stop the bleeding the patient's feet should be placed in hot water.

He should not breathe through the nose but through the mouth only.

If blood comes from the tongue, throat or a tooth, ice or cold water should be held in the mouth, and the carotid arteries should be pressed. A tooth ought to be packed with a piece of clean lint, cotton or linen. If the front of the tongue is bleeding severely, a piece of clean folded linen should be placed on the tongue and pressed down by using the thumb and finger above and below the tongue.

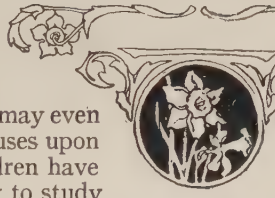
Blood that flows from the ear must simply be wiped away carefully, and further attention left for a physician, as the ear is an extremely delicate organ which must not upon any account be tampered with.

When the doctor arrives he will remove our first-aid pads and bandages so that he can treat the injury properly. He stops the bleeding by the medical method which best suits the nature of the cut, and of course he cleanses and disinfects the wound and all parts near it. Sometimes the lips of a cut are sewed together and sometimes they are held together by bandages. If the wound cannot be closed, a tube or a piece of antiseptic gauze is inserted for drainage purposes to carry off any poisonous matter forming. Healing takes place slowly or quickly according to the injury.

The next lesson in first aid is on page 5980.

THE NEXT THINGS TO MAKE AND TO DO ARE ON PAGE 5763.

FLOWERS OF ROCKY PLACES



MANY boys and girls are fortunate enough to live at the foot of some mountain. Some may even dwell in lonely farmhouses upon the slopes. These children have a splendid opportunity to study wild flowers, for not only do the mountains provide many kinds such as we cannot find growing wild anywhere in the lowlands, but many of the lowland plants will also grow on the mountainside. Some of the lowland plants will not grow at a greater height than a thousand feet above sea-level; and some mountain plants will not grow upon soil less than two thousand feet high, and so on. On the other hand, we may find certain lowland plants growing at various heights.

The term "plants of rocky places" generally means, in America, those of hilly or mountainous country, as our beaches are chiefly sandy. They have no particular character, such as the fleshiness of maritime plants, except in the case of those growing upon the tops of high mountains. In such a position extremes of heat and cold have to be combated, drought is frequent, snow is often present near by, and the winds are terrific. Consequently only those plants that, through the ages, have adapted themselves to these conditions, survive. One finds that usually these "alpine" plants (as those which grow on mountain-tops above timber-line are called, whether in the Swiss Alps or not) are peculiarly dwarfed, spreading, mat-like, in squat, tufted masses, but with brilliant flowers larger than the size of the plant would seem to call for. This compact form, combined with masses of bloom and a certain resistance to drought and to heat and cold, has made the alpine vegetation welcome to the gardener, who plants them on the tiny hillocks he erects in his rockery, and finds that they continue to thrive and bloom.

The low stature of the plants and their close-set branches are, of course, the best form with which to resist the winds and meet their other trials. A tall plant would soon be blown off, and the trees and shrubs, as well as the herbs found high on mountains, are so dwarfed, twisted and contracted as to seem quite unrelated to others of their kind growing at the base. As for their brilliantly hued, large flowers, it is said that "on the heights above the tree-line there is actually no spring and no autumn, only a short summer following a long winter. All the flowers have therefore to blossom in this

short time, and all the flower-visiting insects must do their flying about during the short period which is free from snow, if they do not wish to starve." Therefore, as soon as the snow is melted the flowers appear in every color, alluring the bees, butterflies and flies that depend upon their honey and pollen. By these means the insects are satisfied, and in one way or another they transfer pollen from the anthers of one flower to the pistil of another of the same kind.

There is one family which contains many of these alpine plants—the Saxifrage Family, the name meaning "stone-breaker" and given because the varieties so often spring out of cracks and pockets in cliffs, quite as if they had split the hard rocks to make room for themselves. But some of them, although growing on mountains of the Old World, belong to less elevated places in the New, especially in northern Canada, where they may be found far up in the arctic regions, where the climate is much like that of mountain peaks. Thence they sometimes follow the great cool-topped mountain ranges into the United States, but, generally speaking, rarely occur south of Canada.

MOUNTAIN SAXIFRAGE GROWS NEAR MOUNTAIN RILLS

One such southward-growing species is the Yellow, or Mountain, Saxifrage, that is found about the rock-rills that come down the mountainsides, where its narrow, oblong leaves form large green cushions a foot across. The flowering stems stand well above the cushions and bear a number of scattered flowers, whose yellow petals are dotted with red. The petals stand wide apart and the space is partly filled by the green sepals, upon each of which lies a golden stamen.

AN ORPINE WHICH HAS A ROSE-SCENTED ROOT

Another northern plant that is frequently cultivated is the Rose-root, which is very closely allied to the saxifrages, but is included in that curious family of fleshy plants the Orpines, which can flourish in the most unlikely dry and barren places, and which include the live-forever and the stonecrop. This one, however, unlike most of its family, likes rocks dripping with moisture, and produces thick, fleshy stems and thick, gray-green leaves that are flat, nearly round, and more than one inch across. Its little waxy flowers are grouped in massive heads varying from yellow to purple in tint. Its branching rootstock, when broken, exhales an odor of roses.

THE PINK OR PURPLE FLOWERS OF THE MOSS-CAMPION

A low habit like that of the saxifrages is to be noticed in several of the Pink Family when rooted upon rocks. One of these is the Moss-campion, a plant that is only an inch or two high, with slender awl-shaped leaves. The stems grow in dense spreading tufts that look much like a growth of bright green moss into which somebody has stuck a number of pink or pale purple flowers.

These flowers have no visible stalks, and although they are only half an inch across, they look so big in proportion to the leaves that they appear to have been plucked from some larger plant and set among moss. They are of similar structure to the red campion and white campion of lowland fields and hedgerows. It grows in arctic America and on the summits of mountains as far south as Arizona.

MOUNTAIN SORREL AND THE ALPINE MEADOW-RUE

This herb we shall not fail to recognize as one of the relatives of the common sorrel of lowland fields, although its kidney-shaped leaves differ so much from the common kind. Its spray of flowers, however, allows us to make no mistake. Closely examined, they will be found to have only four sepals, while other sorrels and docks have six. It is not unlikely to be accompanied by the alpine Meadow-rue, whose small leaves, with rounded leaflets in sets of three, are gathered into tufts. This herb does not look very much like the buttercups, to whose family it nevertheless belongs, but closely resembles our other meadow-rues in its tossing tassels of stamens.

THE COLUMBINE PROVIDES THE HUMMING-BIRD WITH FOOD

Neither would the Columbine suggest a buttercup, although a member of the latter's family, as it flaunts its jewel-like gold and scarlet flowers on rocky hillsides. Fitted, as they are, on slender stems that are thrust out from tiny clefts in a rock-face, the columbines tremble in every whiff of wind, and send their yellow pollen flying, to alight on the outstanding pistils of other columbines. Nor are they neglected by insects, though only those with long tongues can reach up into the

THE MOSSY SAXIFRAGE

This is a wild flower of the Irish mountains that is frequently grown in our gardens. It is picturesque, with erect shoots bearing white flowers, and is useful in a rock garden. The leaves are in lobes.

THE YELLOW MOUNTAIN SAXIFRAGE

This is another of the Saxifrages. It grows on wet rocks from Newfoundland and Labrador to Vermont and western New York. In arctic America it grows as far west as the Rocky Mountains.

THE COMMON LONDON PRIDE

This plant is called London Pride because it thrives even in London, where soft-coal smoke ruins plant life. It is one of the saxifrages and grows in gardens in Canada and the United States.

THE MOSS-CAMPION

This densely tufted mossy plant, with the pink and white flowers and the awl-shaped leaves, is found growing only on the summits of higher mountains. It grows in the White Mountains and in the west.

THE BILBERRY

The Bilberry is a plant of many names, whortleberry, whinberry and myrtleberry being most familiar. The leaves are egg-shaped, and the flowers flesh-colored and wax-like. Found on hills.

THE CLETHRA

Clethra can be easily found in swampy lands of the Atlantic coast by the rich, far-flung odor of its waxy flowers, projecting like spearheads from bushes among alders, which these shrubs resemble.

THE WILD GOOSEBERRY

The American Wild Gooseberry flourishes in rocky woods, rooted in the clefts of cliffs and ledges. Its berries look like those of the garden bush, but are considerably smaller and more tart to the taste.

THE FLOWERING RASPBERRY

This gaudy bush shows itself a kind of raspberry, but its flowers alone might deceive one into thinking it a wild rose, to which family it belongs. Its fruit is pretty and it blooms late in summer.

THE ALPINE MEADOW-RUE

This graceful little plant, with its purple flowers, is found principally upon the mountains of Wales and Scotland, and grows about six or eight inches high. It is unlike the family to which it belongs.

THE MOUNTAIN SORREL

This plant resembles the common sorrel of our meadows, but is shorter and stouter. The leaves grow on long stalks, and the green flowers are in clustered spikes. It grows in damp places on hills.

THE GLAUCOUS HONEYSUCKLE

This honeysuckle is a midsummer bloomer which stands upright, holding in its thick double leaves, as in a bouquet-holder, clusters of honey-colored flowers like those of the garden honeysuckle.

THE ROSE-ROOT

The Rose-root is found only in the mountainous districts of the north and arctic regions. It is a relative of the stonecrop. The yellow flowers grow in a dense mass at the tops of the erect stems.

THE WILD SPIKENARD

The Wild Spikenard is one of the loveliest plants of our woods, its white, starry little flowers gleaming in the green shadows. In autumn the flowers give place to the scarlet berries of the thickets.

THE EUROPEAN GLOBE FLOWER

The European Globe Flower, of the Buttercup Family is so called because its pale yellow flowers grow in a globe form. The American Globe Flower is single, with five petals.

THE BLADDERNUT

These are the quaint pouch-like fruits which give its name to the Bladdernut—a shrub which in spring shows us white flowers. The leaflets are in threes. They are mostly small trees, but pretty.

THE PINK LADY'S SLIPPER

Velvety Pink Lady's Slippers nod over sandy forest floors in early spring. The Greek name, Cypripedium (or Venus' buskin), and the Indian one, Moccasin-flower, both refer to the "lip."

THE NINEBARK

The Ninebark has long drooping branches, often swaying down to the grass, in midsummer loaded with ball-like clusters of lovely little white and pink blossoms. It belongs to the Rose Family.

THE BALSAM

The Balsam, or Jewel-weed, grows in mountain swamps. Its golden flowers quiver on slender stalks; the ripe seed-vessels open at the slightest touch, ejecting the seeds, whence "touch-me-not."

THE SEA-PINK

The Sea-pink, or Thrift, is found on seashores and the tops of mountains. The fleshy leaves grow in dense tufts, and the rose-colored flowers in clusters at the ends of the stalks. In Latin it is Armeria.

THE COMMON SCURVY-GRASS

The Scurvy-grass is not a grass at all, but is a member of the Cabbage Family. It is a small plant with white flowers, and grows usually on muddy seashores in the north, and also on lofty mountains.

tips of the horns, where the honey-drops are. Humming-birds stab flower after flower, thrusting them back against the rock with their rapid assaults as they swiftly probe each spur. In the American species the horn-like spurs of the petals are not so strong and hooked as those of Europe, whose size gave rise to the quaint notion that they resembled the necks of doves billing across the stem; whence the name columbine from the Latin word *columba,* which means "dove." Its generic name is *Aquilegia.*

THE BILBERRY OF THE NORTHERN MOUNTAIN RANGES

High on the northern mountain ranges of both hemispheres we find the great Bilberry, a thick-leaved little shrub with blue-black bloom-covered berries that the Scotch call bleaberry. It belongs to the Huckleberry Family, is a near relative of our huckleberries and of the European whortleberry or myrtleberry, and looks very much like them.

Its nearly closed, waxy, white or pinkish bells bend stiffly downward, and when a bee clings to the flowers' opening, and pushes its tongue in to reach the nectar, its head is almost certain to push against the tails of the anthers; and the act, by tilting the tube of the anther and springing the tip, in which there is a chink, away from the pistil, allows a shower of pollen to fall upon the bee's face. We can see from the position of the pistil that when the bee visits the next flower, this pollen will be scraped off upon the stigma.

THE PALE GREEN PRICKLY FRUIT OF THE WILD GOOSEBERRY

There is one little bush, easily recognized, for it closely resembles the cultivated gooseberry, and, in fact, is merely a wild species of gooseberry. It is apt to grow in shady woods, in pockets of the rocks, and often the slender branches, bent down by the weight of the pale green spiked berries, droop from the ledges of high cliffs. It furnishes a tart, wild fruit for sweetmeats, more highly flavored than the tamer kinds, but, in some species, more generous as to prickles, although these are somewhat softened by cooking.

THE FLOWERING RASPBERRY, WITH BRIGHT FLOWERS AND FRUITS

Near the gooseberry, but on sunnier ledges, grows another scraggly, brittle-stemmed bush, bearing fruit quickly identified as raspberries—but very dry and unpalatable raspberries. The whole shrub is furry in appearance. The great maple-like leaves are softly green, and the crumpled magenta-colored petals emerge from a collection of hairy sepals and stems. Even the bright scarlet flattish fruits are fuzzy. This is known as the Flowering Raspberry, and it blooms profusely during late summer, the flowers resembling those wild roses in whose family the shrub is placed.

FLOWERS OF THE HONEYSUCKLE FAMILY, BELOVED BY INSECTS

Several members of the tribe of honeysuckles, both upright shrubs and trailing vines, display themselves on our rough hillsides. One of the earliest plants to bloom is the Fly-honeysuckle, with its pale yellow twin flowers. Much later comes the half-climbing, half-upright Glaucous Honeysuckle, with its close branches of honey-colored, green and purple-tinged flowers, very like those of the cultivated honeysuckles, but half hidden by the wide flaring cup formed beneath them by the union of the uppermost pair of leaves on the stalk.

On dry and rocky ledges, especially common on the islets of the St. Lawrence River, blooms the Bush-honeysuckle, or Diervilla, which has long-pointed opposite leaves and yellow flowers very attractive to bees and other winged insects.

BLACKBERRIES LIKE TO GROW IN ROCKY, MARSHY PLACES

Some blackberries have adjusted themselves to life in hot sands, and creep valiantly under a blazing sun, bearing large white five-petaled flowers like single roses, and later the succulent pulpy fruit that we call dewberries. But the tall blackberries prefer rocky, marshy soil where they can find water to swell their long luscious berries, not fully ripe until the birds begin to steal them. Brandy or cordial made from these berries is used in medicines.

THE CREAMY CLETHRA FLOWERS GIVE HONEY TO THE BEES

The Clethra shrub is sometimes known as a sweet pepper bush or white alder. Although it grows generally among the ordinary alders at the edge of swamp or stream, one species inhabits mountains. The foliage is not unlike that of ordinary alders, but it is the long spikes of creamy-tinted, waxy, thick-petaled little flowers, heavily perfumed and yielding honey for bees, which render the clethra interesting.

THE NEXT STORY OF PLANT LIFE IS ON PAGE 5727.

FLOWERS OF ROCKY PLACES

1. Goldilocks. 2. Thrift. 3. Trailing Daphne. 4. Spicknel. 5. Mountain Forget-me-not. 6. Mountain Bedstraw. 7. Mountain Thyme. 8. Bedstraw. 9. Bearberry.

1. Sweet Cicely. 2. Wood Vetch. 3. Red Alpine Campion. 4. Globe-flower (E.). 5. Pussy Toes.
6. Alpine Bistort. 7. Yellow Pansy. 8. Mountain Avens. 9. Alpine Bartsia.

Flowers marked (E.) are European and are not generally found in America.

1. Cowslip (E.). 2. Red Clover. 3. Wild Radish. 4. Common Fumitory. 5. White Daisy. 6. Candy-tuft (E.). 7. Musk Mallow. 8. Yellow Vetchling. 9. Proliferous, or Childing, Pink.

1. Forget-me-not. 2. Yellow Hop Clover. 3. Meadow Saffron (E.). 4. Garden Sorrel. 5. Chicory. 6. Pepper Saxifrage (E.). 7. Self-heal. 8. Slender Vetch.

The Land of Abraham.

WHY ARE WE LIKE OUR PARENTS?

THE Bible, which calls the descendants of Abraham the "seed of Abraham," furnishes the best and shortest answer to the question Why are we like our parents? In it we read that God said: "Let the Earth bring forth the living creature *after his kind*"—a statement in the simplest possible words of the law which rules that the offspring shall be like the parents of whom they are a part.

We shall examine that kind of living thing from which we get the idea of seed, the living plant or flower. Before a flower will produce seed it has to be fertilized, or sprinkled with pollen. Pollen is made up of very tiny grains, which we may call the male germs of life.

Deep down in the flower is another tiny structure, which we may call the female germ of life, and it can be compared to a plant egg. When the grain of pollen reaches this very simple egg it mixes with it. The result of this mingling of the male and female germs of life is that the plant egg is made to grow, and in course of time it produces a seed.

In this seed are all the mysterious possibilities and powers of life. The seed is really the resting stage of a young plant, and when it is sown and fed by the soil it grows into a plant, which in its turn produces flowers, and the whole process of reproduction is repeated from generation to generation.

A plant with roots and stem and leaves and flowers is a very much more complicated thing than either the pollen or the little plant egg; yet in the pollen and in the plant egg together there must be something which is capable of giving rise to the plant. This something, this power of growth and further reproduction and all besides, must all be in the substance of this germ of life. Scientific men call the substance the *germ-plasm*. This substance, though the most powerful microscope can reveal only a little of its structure, must be really extraordinarily complicated. It must be made also in a special and singular way, because it does not give rise to any particular plant, but to only one kind of plant—a living plant *after its kind*.

Exactly the same is true of all living creatures, men and women among them. The substance of the egg of life—that is to say, the united male and female germs of life—expands into the child, whose body from its birth is influenced by all sorts of things in the world outside, and grows up into a man or a woman seemingly more different from other men and women than plants are from others of

their kind. But a portion of this man or this woman, namely, the life-germ, or the germ-plasm, is set aside for reproduction to carry on the race. Sheltered within the body, it is not exposed to any influences from the world outside, and remains unaltered to form the material for the next generation of men and women. The bodies of men and women from generation to generation may differ, but the germ-plasm goes on. It is the life-power of the race. It *is* the race, it *is* the family, with all the family's changeful peculiarities and powers.

It will therefore be seen that everything a child has, every physical and mental and moral gift, must have been in the germ of life furnished by its father or by its mother, and must have been produced by the mingling of these two germs. The marvel is, not that children should be like their parents, but that they should be unlike them.

The explanation which has been offered by some modern biologists—called the Mendelians, because they follow the teaching of the wise old monk Mendel—is that each half of these germs of life, the female and the male half, is alike in this, that it contains unnumbered powers and possibilities, and that sometimes, in the combination, some of these powers will modify one another, or strengthen one another. Then in the offspring some peculiarity will be more pronounced than in either father or mother.

But, as far as human experience goes, children have nearly always something that is recognizably like both mother and father. This is especially true in matters of the mind, and the late Sir Francis Galton, who founded what is called the Science of Eugenics—the science of human welfare—showed by collecting records of noteworthy families that intellectual genius is frequently carried on. In some cases, however, the son of a distinguished man is completely overshadowed by his father's greatness.

IF THE GASES IN WATER MAKE FIRE, WHY DOES WATER QUENCH IT?

The first part of the answer is that, as the oxygen and hydrogen of water are already burned up with each other, they can be burned up no more.

The second part of the answer is that water puts out fire for two good reasons. Everyone can understand that if a thing is covered with water the oxygen of the air cannot get at it to burn it; but the most important reason why water puts out fire is that water has a great capacity for heat, and can hold a great deal of it. It takes so much heat into itself, and so quickly, that it lowers the hotness, or temperature, of the burning thing so that it can no longer burn.

In chemistry "to burn" means to unite with oxygen. In a grate fire we know that the coal is uniting with the oxygen of the air. As it unites heat is given out.

Water is made up of two gases, hydrogen and oxygen. Hydrogen burns. Oxygen supports burning. When hydrogen unites with oxygen an entirely new substance is formed, not a gas but a liquid, water. Water does not burn. If burning coal is covered with water, oxygen cannot get at it, so there can be no more burning. Water also takes heat to itself and lowers the temperature of the coal so that it can no longer burn.

WHY DOES A RIVER CURVE AND TWIST RATHER THAN RUN STRAIGHT?

The course of a river-bed depends on the lie of the land. If this changes, the course of the river will change. The water runs downward to the sea, pulled by the earth's attraction as near as it can get to the centre of the earth. It chooses the easiest downward path across plains or through valleys. If it encounters a mass of rock or a rise in the ground, it flows around the obstacle. Even where a river appears to run straight there is a change in level downward toward the sea.

When we notice the ordinary curves and twists in a river we may see no good reason for them, but that is only because we cannot see accurately enough. If we use a special instrument to show us "how the land lies" at any point, we shall find that the river is really doing the only thing it can—running downward.

WHY DO THE TELEGRAPH WIRES VIBRATE OR HUM?

Anything stretched is apt to be thrown into vibration, or made to tremble, by the force of the air blowing against it. If it vibrates so fast as to produce air-waves that our ears can hear, we call the result sound. This is what happens to the telegraph wires when they hum. If we put our hand on the telegraph pole we feel the wires vibrate strongly enough to set the whole pole trembling, too. If we think of the way our own voices are produced we see that the telegraph lines hum

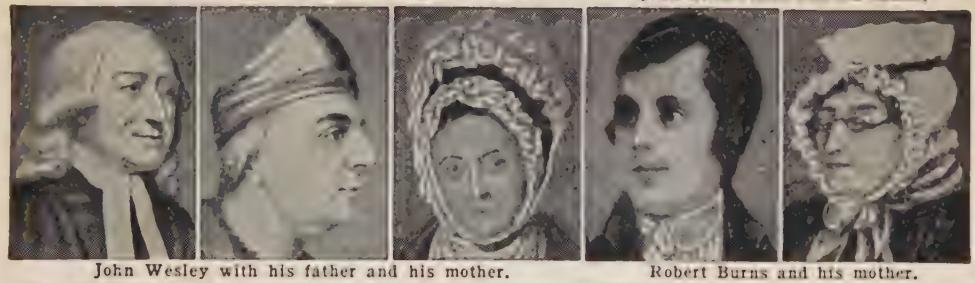
FATHERS, MOTHERS AND CHILDREN

On page 5613 a scientific contributor answers the very interesting question Why are we often very much like our parents? Here we give the portraits of a group of famous men and women with their parents.

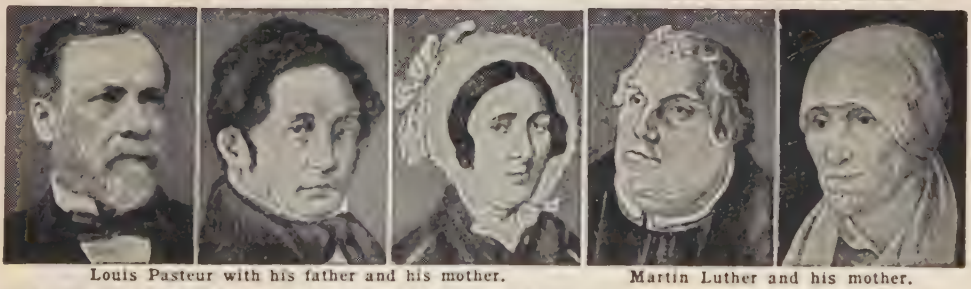
William Pitt with his father and his mother. James Nasmyth and his father.

Charles I with his father and his mother. Lord Kelvin and his father.

Thomas A. Edison with his father and his mother. John Stuart Mill and his father.



John Wesley with his father and his mother. Robert Burns and his mother.

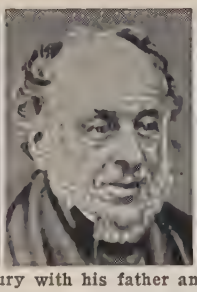


Louis Pasteur with his father and his mother. Martin Luther and his mother.

The portrait of Lord Kelvin's father is from Mrs. King's book on Lord Kelvin's Early Home (Macmillan). Others are by courtesy of Mr. E. G. Pretyman and Messrs. Russell.

R. W. Emerson with his father and his mother.

Earl Shaftesbury and his father.



Lord Salisbury with his father and his mother.

Wordsworth and his mother.

Sir Walter Scott with his father and his mother.

Oliver Cromwell and his mother.

John Ruskin with his father and his mother.

Sir Joshua Reynolds and his father.

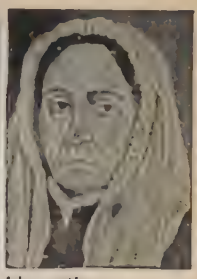
Charles Dickens with his father and his mother.

Sir Robert Peel and his father.

Some of these portraits are reproduced by courtesy of Sir H. F. Dickens, Mr. A. Severn, Messrs. Elliott and Fry, and Russell.

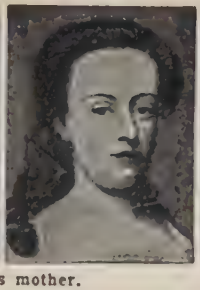
Alexander Graham Bell with his father and his mother.

Christopher Wren and his father.



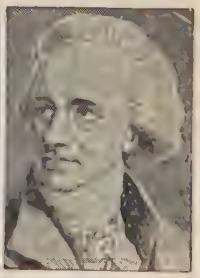
Queen Elizabeth with her father and her mother.

Mazzini and his mother.



Nelson with his father and his mother.

Dr. Johnson and his father.



Nansen with his father and his mother.

Sir John Herschel and his father.

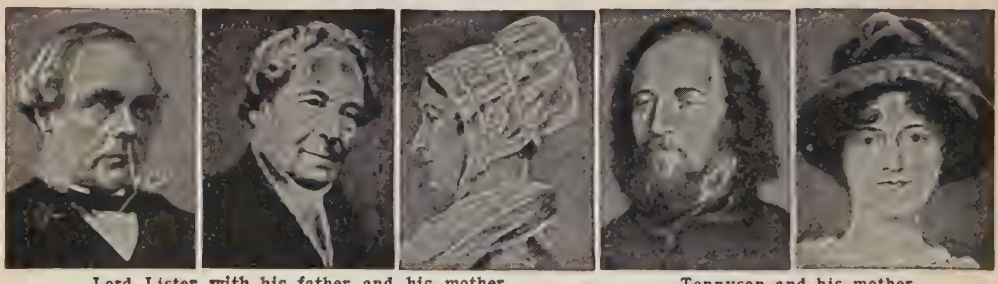
Louis XIV with his father and his mother.

General Booth and his mother.

Some of these portraits are given by courtesy of Earl Nelson and Mrs. Florence Horatia Suckling, of Highwood.

Shelley with his father and his mother. Washington and his mother.

Charlotte Brontë with her father and her mother. Wellington and his mother.

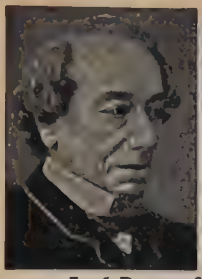


Lord Lister with his father and his mother. Tennyson and his mother.

James I with his father and his mother. Tolstoy and his father.

Gladstone with his father and his mother. R. L. Stevenson and his mother.

Some of these portraits are given by courtesy of Lord Tennyson, Sir Rickman Godlee, from his life of Lord Lister (Macmillan), and Sir John Shelley-Rolls, Bart., from Roger Ingpen's book on Shelley in England (Kegan, Paul).



Lord Beaconsfield with his father and his mother.

Francis Bacon and his father.

Napoleon with his father and his mother.

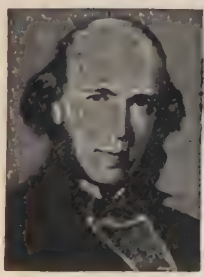
George Eliot and her father.

William Cowper with his father and his mother.

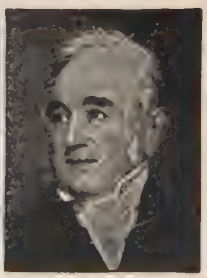
Thomas Carlyle and his mother.

John Bright with his father and his mother.

Matthew Arnold and his father.



Herbert Spencer with his father and his mother.



Robert Stephenson and his father.

Some of these portraits are from Herbert Spencer's Autobiography (Williams and Norgate), Mr C. M Trevelyan's Life of John Bright (Constable), Mr. T. Wright's Life of Cowper. Others are by courtesy of Mr. Ralph C. Disraeli.

in exactly the same way as we hum ourselves. In each case something stretched is made to tremble.

WHY DOES A MATTRESS HAVE LEATHER BUTTONS?

If the stuffing of a mattress were simply put in the case without any fastening it would soon all work down to one end, and the mattress would be uneven and uncomfortable. To prevent this every mattress is sewn through with string, which is fastened to the buttons we see outside. The stuffing is thus kept evenly distributed in small compartments.

WHERE DOES THE SPRING-WATER COME FROM?

Spring-water comes from the sky. If we live in the country we soon find that the springs are dependent on the rain, and when there is little rain, or none at all, the springs dry up. This is true even though the spring-water is seen coming from the earth, for what we see then is rain-water that has soaked into the earth and found its way to the surface again at the spring. Spring-water runs at last into a lake or a river, and so to the sea, from which the sun sucks it up again, to send it down as rain. This goes on ceaselessly. The same water passed through spring, sea, sky and earth thousands of times before we were born.

Spring-water is very good to drink, for it is pure, it has a lot of air dissolved in it which gives it a pleasant taste and sparkle, and it has dissolved in itself from the earth through which it passes a number of salts that are very good for us.

WHAT IS THE FORCE IN LIGHTNING THAT KILLS A MAN?

We use the word lightning to mean two distinct things—the flash seen when electricity passes strongly from a cloud to another cloud or from a cloud to the earth; and the electricity which causes that light. The flash is quite harmless, but the electricity is very different. If this strikes the ground close beside a man it will do him no harm; but if it actually passes to the earth through his body it may kill him. If the lightning charge is sufficiently strong it will affect the brain and the nerves that run from it to the heart. Two of these nerves, one on each side of the body, are capable of stopping the heart altogether if they act powerfully. The electricity, in passing, excites these nerves so that they stop the heart, and the person dies from shock.

WHY DOES THE AIR NOT STOP THE LIGHT OF THE SUN?

The air *does* stop a great deal of the light of the sun. Rays of heat and rays of light are similar, and the sun sends out both. The air stops heat rays as well as light rays. The sun and the moon and the stars appear far brighter when we go up in an airplane, or if we look at them through a telescope on a mountain, where their light has to pass through less air to reach our eyes. The air is a blanket and prevents the passage of light and heat to a great extent, whether from outside space to the earth or from the earth to outside space. If there were no air, the light or heat of the sun striking the earth would be vastly greater than it is. Around the moon there is no air. If there were, even on cloudless nights the moon would be not nearly so brilliant as it is, for a great deal of the sun's light now reflected by the moon would be absorbed by the air around it.

WHAT CAUSES WOOD EXPOSED TO DAMPNESS TO ROT AWAY?

There are kinds of wood that will not rot away, even though they are kept in water. The city of Venice is built on wooden piles buried in the shallow sea, and these have lasted for many centuries. This wood does not rot because the things that make wood rot cannot attack it. Wood does not rot without a cause.

We shall guess what it is that makes wood rot when we learn what is done to wood that must be exposed to wet and yet must not rot—for instance, the wood of which railway ties are made. These are often soaked with a chemical substance called creosote; and the particular property of creosote which makes it so valuable is that it is poisonous to microbes. So the answer to the question, in one word, is: Microbes. Wood will not rot if it is charged with something that kills microbes, or if, as in the case of Venice, it is protected from microbe enemies by being kept in salt water.

OF WHAT USE IS THE NOTCH AT THE TOP OF A BIG SAW?

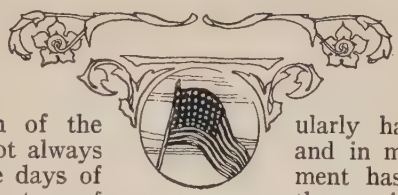
In sawing a beam or a thick plank the carpenter is often delayed because sawdust and splinters get wedged in the cut and make sawing difficult. When this happens he takes out the saw, turns it upside down, and uses the notch to clean out the cut.

THE NEXT WONDER QUESTIONS ARE ON PAGE 5739.

WHAT THIS STORY TELLS US

CHILDREN are considered much more important now than a hundred years ago. This story tells some of the things which one great city is doing to help its children to become strong men and women. The schools are of course important, but we shall see that many things besides instruction are offered to our children; for it is of little use to teach a child who will grow up into a hopeless invalid. Besides the schools, the libraries are one of the most important means of education in the city. The little immigrant children are more eager to get an education than those whose parents were born in the United States.

WHAT A GREAT CITY DOES FOR CHILDREN



CHILDREN mean much to the welfare of a nation. They are the men and women of the future. People did not always think of this. In the days of which we read in our story of Child Life in Colonial Days it was believed that children's wills must be broken, their minds and bodies completely subjected to their parents. A child was merely an unregenerate little being who "must be seen and not heard."

To-day the world is awakening to the supreme importance of the child. It is beginning to realize that in the hands of the children will some day rest the government of the nation and the making of our homes, and that if we wish the United States to continue a strong and mighty republic, we must carefully look after the training of our children. New York, Boston, Chicago and many others of our large cities have found that if they would have healthy-minded, wholesome-bodied citizens they must see that the minds and bodies of their little ones are properly cared for—that the children are properly fed and clothed, properly housed and properly taught, or else the well-being of the child and of the community will suffer. The parents in many cases are too ignorant or too poor to do all of these desirable things for their children.

New York City, with its ever changing, ever growing population of immigrant children, has a particularly hard problem to face, and in many ways its government has responded nobly to the crying need for child-training and child-welfare work.

The Board of Child Welfare supports children of parents who are unable to support themselves. It does this, not by placing them in institutions, but by contributing money donated by the city to the support of these children. At present it is supporting more than 27,000 children in the city. About 85 per cent of the children which it supports are the children of widowed mothers, the rest being children whose fathers or mothers have been committed to insane asylums or sent to prison for five or more years. The purpose of this work is to try to keep the family together instead of sending the children to institutions. The parents of the children must, in all cases, be either citizens of the United States or have taken out their first papers.

New York City has a system of public schools which, though perhaps not all that it should be, still accomplishes wonders with the children with whom it has to deal. It takes many of them from dirty, crowded tenements and undertakes to lay a firm foundation for good citizenship and good home-making. Children, accustomed to the squalor and filth of the

tenements, enter school with no knowledge of English. In a few years they leave the school, but with what a difference! They have been trained in personal cleanliness, and many have responded to the training; they have learned the language and have a fair knowledge of the land in which they live. And they are proud of their knowledge, proud of their school and their teachers, and, above all, proud of the great United States—the country of their adoption.

Many children have to work before they can go through the high school, but if they are ambitious they may attend high-school classes in the evening and there carry on their studies. Above the high schools there are two great colleges, one for boys and one for girls, where, as in all the city schools, books and tuition are paid for by the city. Both of the colleges also give courses in the evening and during the summer.

Mothers' meetings, and the little mothers' league

So that they may better understand the children, the teachers of the public schools try to work with the fathers and mothers. For this purpose mothers' meetings and parents' associations have been organized, and at the meetings parents and teachers talk about the children and discuss the best way to bring them up. Some of the parents themselves need to be taught and are asked to listen to talks by doctors or well-trained nurses.

The grown-up mothers, however, are not the only means by which the little ones are reached. An association called "The Little Mothers' League" has been formed of the older sisters who often have entire care of the babies, and in many cases these "little mothers" are found to be taught more easily than the mothers themselves. Sometimes mothers who will not listen to the nurses will learn at home what their little daughters have been taught.

Visiting nurses and physicians

The city hospitals and the public schools in New York City have physicians and visiting nurses connected with them, who go to the homes of the children.

The Bureau of Child Hygiene supervises the health of children from the time they are born until they are able to go to work. Child-hygiene stations are located throughout the city. A nurse is in charge at all times, and twice a week clinics are held by a doctor. They instruct mothers in the proper care of children, and especially in cleanliness. Milk is sold at these stations at a lower price than at the stores. This is done in order to induce mothers to use the stations. By this work the death-rate of infants of less than a year has been reduced from 333 per 1,000 in 1915 to 66 per 1,000 in 1924.

The Tuberculosis Hospital at Sea View, Dongan Hills, Staten Island, takes care of children who have contracted either pulmonary tuberculosis or bone-and-joint tuberculosis. The treatment now used is called heliotherapy, or sun treatment. Besides using pure sunlight, on dark days the quartz mercury vapor lamp is used, and this lamp, radiating violet rays, has practically the same effect as the rays of the sun. At Sea View also a preventorium is in operation. To this institution come children from homes where there is tuberculosis. They are taken care of so as to prevent their contracting the disease. They are fed well and given plenty of air and exercise.

The healing camp on the schoolhouse roof

But not all the little tubercular children of the slums can be taken into the seaside homes, so roof camps have been established where the children can spend the days in the open air. The patients arrive at the camp each morning at nine o'clock and are at once given to drink a glass of fresh milk with a raw egg beaten into it. Then the children have their lessons almost as they do at school. At noon a plain, wholesome dinner is served, and in the afternoon another glass of milk with a raw egg is given. Promptly at five o'clock the camp closes, but the unhealthful conditions of the home are not allowed to spoil the good effects of the open air.

Nurses and physicians visit the tenements and see that the lightest, airiest room is given to the patient. They see that the linen and the eating utensils of the patient are washed separately, and give tickets for two quarts of fresh milk and three raw eggs a day. The day camp is one of the many wise agencies provided by New York City in the struggle against the great White Plague. Over 250,000 children from the city go to summer camps every year.

GETTING CLOSE TO NATURE IN THE CITY

From the poor, timid little strangers entering the country through Ellis Island to these rugged little Americans working away at their garden plots, is quite a step. This is one of the garden blocks in the upper part of New York City, where the children, under instructors, learn principles of gardening.

The Department of Parks, City of New York, conducts several children's gardens or farms. Over 150,000 children attend these gardens during the year. Here we see the DeWitt Clinton Park Garden at Fifty-fourth Street and Eleventh Avenue.

PLAYGROUNDS IN THE OPEN AIR

But after all, though it is wise and kind to help the sick ones back to health, the real hope of the country lies in healthy children who will grow up to be strong men and women. The city realizes this, and has set itself to the task of keeping the well children robust and happy, and providing them with wholesome employment for their brains and bodies. For this purpose it has established open-air playgrounds, roof gardens, recreation piers, bathing-pools, garden plots, and athletic grounds, and has secured jolly, wholesome young women and men to teach the children how to play, for unhappily many children of the crowded streets do not know how to play even simple games, and must be taught.

The settlement workers among the children of the slums count the roof gardens as one of their most valuable helps. All the newer public schools in New York are built with roof playgrounds inclosed with wire netting and floored with tile. Here the children learn baseball and basketball and even tennis, and perhaps in the evening there are gymnasium classes and dancing classes.

Many of the model tenements are built with roof gardens, and many of the day nurseries of New York City have summer roof gardens, where the little ones left in the care of the nurses can play in the open air until that best of medicines begins to bring the pink glow of health to their pale cheeks.

Then there are the playgrounds where a fellow can play ball just as much as he likes without being taken up by the "cop"; where there are swings and rings and bars and trapezes and tennis courts and sand piles, and other delights. From the oldest boy and girl to the tiniest of the little folk there is something for all to do—and all this away from the dust and clamor of the hot streets.

The value of the public parks as playgrounds has also been recognized, and in the spring and early summer the children of the schools are taken to picnic there, and it is there that they give exhibitions of folk dances. Teachers go to the big public schools to teach the children how to dance the dances that their fathers and mothers and their forefathers for generations danced perhaps in far-off Russia, or in Poland or Italy or Germany. Many of these children were born in Europe. Perhaps the first thing that makes them feel they are at home is the dancing class in the big gymnasium.

The public parks, too, are often the scenes of games by boys and girls in flag drills and other forms of patriotic plays. So the old is linked with the new, and the little foreigners at last begin to feel that they are really American citizens.

RECREATION PIERS, PUBLIC BATHS AND SWIMMING-POOLS

Dancing is taught also at the recreation piers, which have been built at various spots along the Hudson and East rivers as breathing-spaces during the summer for the children living in the hot, crowded tenement districts of the big city. These piers are open from May until September, and there is a concert on each pier every evening from eight o'clock until ten o'clock.

For the hot months the city provides an elaborate system of free baths and swimming-pools for its boys and girls, where they can swim and splash about in the cooling water to their heart's content. Teachers are provided to give the children lessons in swimming and diving and other water sports, and the children in their play learn the real value of cleanliness.

THE FIRST JUVENILE LIBRARIES

Anne Carroll Moore, the pioncer of juvenile libraries in this country makes the following interesting statement:

"America was the first country in the world to give boys and girls a place of their own in a public library, between thirty and forty years ago. The first children's room to be included in an architect's plan and equipped for the comfort and convenience of children from picture-book to high-school age was that of the Pratt Institute Free Library, Brooklyn, New York, opened in 1896. Its low reading-tables and small chairs of different heights, designed from specifications of a well-known specialist in hygiene, have become a familiar feature of other children's rooms. Their measurements have been standardized and are accepted as part of the equipment of every American public library, large or small, and they have been copied in Sweden, Norway, New Zealand,

FRESH AIR AND FUN FOR THE CHILDREN

Here is a picture of a corner in one of the many roof playgrounds in New York. These playgrounds on the roofs of city schools, far above the hurly-burly of the city streets, and out of reach of its dangers, provide happy, healthful places of amusement for the little children of the slums.

Fresh air is the most essential thing in the world for a sick child, and the floating hospitals, the ferry-boat schools and the seaside homes that New York City and its charitable organizations provide for its suffering little ones, bring health and rosy cheeks to many who would otherwise die.

New York has one of the best organized systems of public playgrounds in the world. Here we see a group of boys under the care of two of the city game teachers. Baseball, basketball and tennis are among the games taught the boys. Sad to say, children of the streets often have to be taught to play.

WHERE CITY CHILDREN REGAIN HEALTH

The Department of Health conducts many open-air schools for the delicate children of New York. Our picture shows the platform of the cottage school in Thomas Jefferson Park. This is known as Annex Public School 159, Manhattan, and is for anæmic children.

The Tuberculosis Hospital at Sea View, Dongan Hills, Staten Island, takes care of children who have tuberculosis of the lungs, bones or joints. The treatment shown in this picture is called heliotherapy, or sun treatment—quartz mercury vapor lamps radiate violet rays which have practically the same effect as sun rays.

Photo, Ewing Galloway.

This picture gives a good idea of a children's reading-room in a public library. Hundreds of school children go to a library every day. Above the fourth grade in the public schools many pupils are regular visitors in search of books which have been mentioned in their classwork.

Roller-skating races are held in all the city parks, and the finals for the championship take place in the Mall of Central Park. Here we see the boys and girls of John Jay Park watching a contest and waiting eagerly to take part in the sport.

France, Belgium and in other countries.

"The Central children's room of the New York Public Library has a cheerful red-tiled floor and deep window-seats where boys and girls love to curl up and read by the hour. In many of the branch libraries in New York, Brooklyn, Utica, Cleveland, Detroit, St. Louis and other cities there are fireplaces with andirons holding blazing logs on winter days round which groups of children sit on settles, benches or in armchairs. Children's rooms are of different sizes. The Brooklyn Public Library has one entire big building for children in a crowded district. The Carnegie Library of Pittsburgh has several rooms opening into one another. In the new central building of the Cleveland Public Library the children's room is named for Lewis Carroll, and a room for boys and girls of high-school age on the same floor is named for Robert Louis Stevenson.

"The most complete and beautiful small library building yet designed for children is at Westbury, Long Island, New York. It is a memorial to Robert Bacon, late ambassador to France. At one side of the library is a bird sanctuary with a deep pool, and in the fir trees and shrubbery there are sun parlors for the birds. Inside the library there is a notable selection of books about birds and gardens, and on the wall is a wonderful decorative map of Long Island showing all the native birds and flowers in colors. This library has many rare old children's books and pictures, and plenty of new books for the boys and girls to take home are in daily circulation.

"One of the most interesting things that happens in a library for children is the weekly story hour, which often begins on Hallowe'en and ends for the season in April or early May. All kinds of stories are told—fairy and folk tales, stories from history and legend, the great national epics, and stories of high adventure. The selection depends on the ability of the story-teller and the tastes of the children. The library story hour should broaden and strengthen tastes for real literature and help to promote the love of reading for reading's own sake. Library reading clubs for older boys and girls are held in many libraries, and in these clubs very lively discussions of books take place.

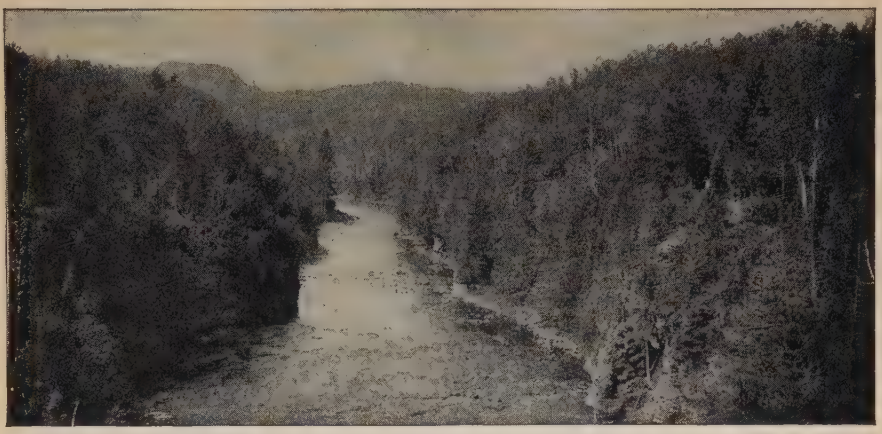
"Every children's library room needs a good-sized collection of books for school reference and general reading in the room. The best illustrated books, such as Boutet de Monvel's Joan of Arc, Howard Pyle's Book of the American Spirit, and Randolph Caldecott's Picture Books, belong in such a collection. But the most important things to have in any children's library are a fine selection of books with plenty of duplicate copies, good pictures, and a librarian who knows these books and other books well enough to introduce them effectively without spoiling the fun of boys and girls who like to discover books for themselves.

"The work of a children's librarian requires special training and courses of continuous reading, for she is expected to advise parents and teachers about children's books and reading, as well as to help children of widely differing tastes and ages in their selection of books for reading at home and in the freer use of books as aids to study in school and out.

"Classes of children from public and private schools frequently spend an hour of school time in the children's rooms of public libraries. Sometimes they ask for a story to be told, sometimes for a talk about books illustrated by reading from them, and sometimes they want to spend the whole hour browsing at bookshelves or reading-tables.

"The children's library has been well called 'a nursery of good citizenship.' Its rules are very simple—clean hands, and respect for the other fellow who may wish to read quietly. 'It's better than any school,' said one small boy, 'because you don't have to go unless you want to, and you can go home when you please.' To make of a children's library a place to which children like to come often and sometimes to bring their fathers and mothers and grandmothers—a place from which there flows continuously a stream of interesting new book-associations alongside the old and tried; a place that never grows static or stale, but seems fresh and alive to each new generation of readers—this is to make a successful children's library. Attractive physical equipment merely helps express the idea—'a new idea in education' it has been called by visitors from across the Atlantic."

THE NEXT STORY OF THE UNITED STATES IS ON PAGE 5653.



Photo, Kenneth M. Wright.

Pigeon River, a part of the boundary between Ontario and Minnesota.

FISHES OF RIVER AND LAKE

THE stream, the lake, the river are counterparts of the land. They have their teeming life in many forms. They have their stay-at-home citizens who covet no more than one straight little run of reedy water, and travel no more than the European peasant of to-day.

Some are as restricted in their travels as the tortoise; some must stay where they are because they cannot go down toward the river's mouth lest salt water should kill them; some live in water in the estuaries which is neither fresh nor salt, but brackish. But there are others which can pass from river to sea and from sea to river, making great voyages.

Every stretch of fresh water is as a world to itself. It has its natives, its invaders, its raids and battles, its searches for food and comfort, its triumphs and its failures. The river has its explorers which go forth from their homes never to return. Others, as the salmon and trout, change their method of living and swim from placid streams out into the ocean, and come back in due season to scale mountains in the water on the way to their nursery grounds.

For the falls up which the salmon leap must seem mountains to them. Up and up they go, from rock to rock, resting a moment, then flicking upward till the last height is mastered, and smooth water, deep and friendly, again invites the courageous navigators. There is nothing on land, nothing in the sea, which faces more amazing adventures than the eel and the salmon.

Battle and death are the normal sequence of events which lead fish to their dinners in our inland waters. The big fish eat lesser fish, lesser fish eat smaller fish, the smallest eat the water fleas and other insects, and the water fleas and their comrades eat the green vegetable life of the stream. The process is similar, we see, to that on land, where the herb-eaters convert vegetation into flesh and blood, and themselves serve for food to maintain lions, tigers and other devourers of flesh.

In the old days fish ran a course like that which man himself afterward followed. They grew armor, first of thick scales, and then of bone. But the sluggish fish in armor could not keep their place in the race of life any more than the men in armor whom gunpowder blasted from their moving fortresses.

The lithe unarmored fish survived

and became the common species in the waters. Happily, examples of those strange beasts of the fluid world still remain with us to make the incredible credible. The Sturgeons linger with us yet, the greatest sometimes eighteen feet long and weighing hundreds of pounds.

The biggest American example of the Common Sturgeon of recent years, which was caught in 1911, measured over ten feet, but the Pacific sturgeon has been known to reach a length of thirteen feet and to weigh a thousand pounds. The Lake Sturgeon is much smaller, and so are the Short-nosed Sturgeon and the Shovel-nosed Sturgeon.

Possibly many larger ones fall to the tens of thousands of peasants who yearly line the banks of Russian rivers as the fishes swarm in hundreds of thousands from the sea to lay their eggs in the fresh water. It is not so much the flesh of the sturgeon they seek as the roe, which is a solid mass of eggs, three million and more to a single sturgeon.

This roe, prepared and salted, is preserved and sent about the world as a costly luxury, caviare; but to the Russian peasants it is a common food. Now the old rule applies again to the sturgeon—many eggs reveal manifold chances against baby sturgeons reaching full age. Grown up, the sturgeon has few enemies but man to face, we must suppose, for it retains the old-time armor, a heavy mail of bony plates covering its great tubular body.

The harmless sturgeon in its heavy coat of mail

In appearance it is as terrifying an object as a swimmer is likely to meet in the water, yet in reality it is harmless, toothless, a mere grubber in the sand and ooze of sea and river bed after worms, little fish, and small life in shells. So the young of the species cannot expect to make much of a battle for life against enemies sharper of teeth and appetite. The sturgeon is the best example in the waters of the fish in armor, and the disappearance of the order of which it is the relic shows that armor is a failure.

One of the great difficulties in describing fishes is the fact that they are called by so many different names in different sections. Very often these names are based upon some resemblance to another fish of an entirely different family that the early settlers had known. As a result many fishes of one family are called by the name of another. This is true of the names of many of our birds and flowers also.

The lively perches of lake and stream

There is nothing so impressive in the workmanship and build of a perch, yet the perch is a thriving, lusty fellow, abundant in our lakes and clean streams of the eastern part of the continent. Instead of defense this fish has invisibility, or something near it.

The Yellow Perch with its stripes is a beautiful example of camouflage in the water. The keen-sighted angler may detect the presence of a salmon without actually seeing it; he discerns the shadow cast on the gravel as the gliding salmon swims above it. But the perch is more likely to swim over vegetation where such a shadow cannot easily be seen, and the stripes break up his outline and render him still less visible. Some of the most gorgeous of fishes living among the coral reefs of the tropics are very perch-like, with a color-scheme that serves as a sort of livery.

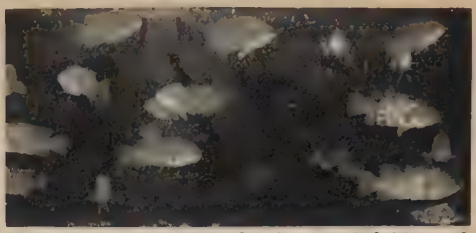
Another perch is the Wall-eyed Pike, or Pike Perch, found in the Great Lakes and in many other lakes and streams in the eastern half of the continent. Rarely it grows to be as much as three feet long and weighs as much as twenty-five pounds, but nearly all caught are much smaller. A near relative, the Sand Pike, or Sauger, is found much farther west.

The perches are bold and audacious, and, thanks to the great spiny fins, dare to live in the same waters as the pike. The Sunfishes, of which there are many species, may be found in similar waters. They are common in many American rivers and can be regarded as modified perch, with the same spiny fin. We have many species, all peculiar to North America. If they were a little larger, they would be important food fishes, but only a few species grow to be more than six or eight inches long. The Common Sunfish, or Pumpkin-Seed, is eagerly sought by small boys. It fights as hard as a much larger fish.

The basses have been taken to europe

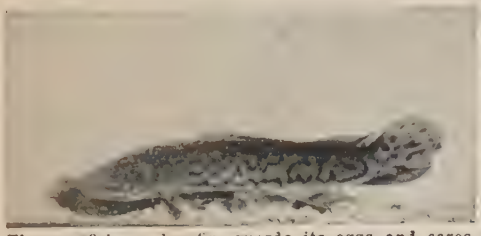
The fresh-water basses belong to the same family. The Rock Bass is common in most of our lakes and rivers except in the extreme West. It grows to be as

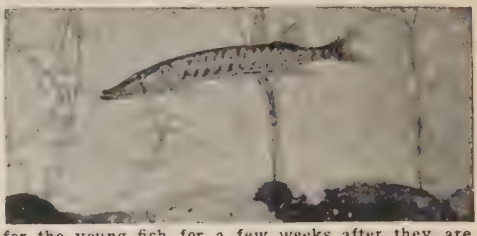
FISH OF AMERICAN RIVERS AND LAKES



The brook trout is found in the streams and rivers of the East. This little fish is a good fighter and affords fine sport for the fisherman. The rock bass is found in every lake, river and stream of the Great Lake region and the Mississippi Valley. It is more plentiful and easier to catch than the brook trout.

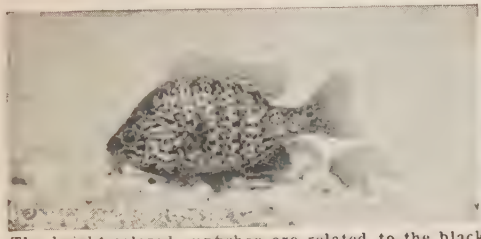
The beautiful black bass, a native American fish, was originally found in the great central plain region of the continent, but has been transplanted to the eastern and the western states and to Europe. Our yellow perch, which is smaller than its European cousin, is usually found in schools. Both these fishes are good for food, and the black bass is the joy of the angler's heart.

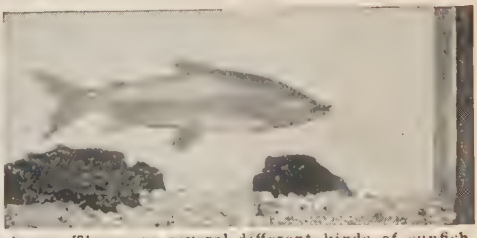




The mudfish, or bowfin, guards its eggs and cares for the young fish for a few weeks after they are hatched. The little pickerel—a member of the Pike Family—is found in the streams and ponds of the North. It is a small fish, but, like all pikes, is very greedy. It is seldom more than twelve inches long.

The short-nosed gar, which is not good for food, has its habitation in our northern rivers. The maskinonge, or muskallunge, which belongs to the great Pike Family, is a very greedy fish, but, like most of the pikes, is good for food. It is found in the Great Lakes, and the lakes of Canada, the Ohio Valley, and some of the northwestern states. It sometimes weighs as much as one hundred pounds.





The bright-colored sunfishes are related to the black bass. There are several different kinds of sunfish found in many parts of the United States. The common whitefish is a relative of the salmon, and lives in all the lakes of the Great Lake region. It goes up streams and rivers to lay its eggs.

much as twelve inches long, and loves to dwell in deep water near rocks. It is a voracious feeder and eats many minnows.

The Black Basses, both Small-mouthed and Large-mouthed, are found in many of our rivers and lakes, and have been introduced into European waters, where they do well. Both are excellent food, and fishermen like them because of their gameness. Some fishermen say that they are harder to land than either salmon or trout. The White Bass belongs to an entirely different family. It is common in the region of the Great Lakes. The Striped Bass spends most of its time in salt water and enters the rivers only to spawn. It is common on the Atlantic coast and has been introduced into the Pacific. Striped bass weighing over a hundred pounds have been taken, but large specimens are becoming rare.

THE CATFISH FAMILY IS FOUND IN BOTH HEMISPHERES

The Catfish Family is a very large one and is found in the warmer waters of the world. South America and Africa have most of the species, some of which live in salt water. North America has more than thirty fresh-water species, but none is native to Pacific waters. The Blue Cat is common in the Mississippi and elsewhere, and attains a great size. It is a good food fish. There is a catfish in the Great Lakes and in certain Canadian lakes which some scientists think is the same fish, but it does not grow to be so large. Several other species are caught for food.

Belonging to the same family are the bullheads known to every small boy. The Common Bullhead, or Horned Pout, is found in most of our inland waters. It has been introduced into some of the streams of the Pacific coast and thrives there. It is a stupid fish which loves the muddy bottoms of streams and lakes. It is greedy and usually swallows the hook, no matter what the bait. Every boy who has ever caught a bullhead has been pricked by the spines behind its head. We are told that the old bullheads look after the young as an old hen would care for her chickens. In Europe the name is applied to another fish even uglier, which is known also as the Miller's Thumb.

THE STICKLEBACK WHICH BUILDS A NEST

Another spiny fish is the Stickleback, found in all the colder waters of the northern hemisphere. There are about twenty species, none over seven inches long. On their backs and their gleaming bellies are spines as sharp as needles which cause most other fishes to avoid them.

Even these weapons are not an invariable safeguard against pike. It is on record that a stickleback in an aquarium dined by nibbling at a pike's tail; but, contrary to belief, hunger-driven pike will banquet on sticklebacks. A reader's letter tells of finding thirteen highly prickly sticklebacks in the stomach of one pike. Still, the defense is usually strong enough, and sticklebacks thrive in millions in many places.

The male makes a beautiful nest in the water and leads a female to it. When she has laid her eggs, she is made to depart. Sometimes several females lay their eggs in one nest. Then the male takes charge and watches over the eggs with furious affection, charging at any trespasser. When the babies are hatched he shows all the skill and courage of a proud hen with her family of chickens.

ONE OF THE LARGEST FAMILIES OF FISHES

Now let us turn to the great Carp, or Minnow, Family, one of the largest of all. Most of the species are of small or moderate size, and many species are so much like others in size, shape and color that even the scientist is often puzzled. About 225 species live in North American waters.

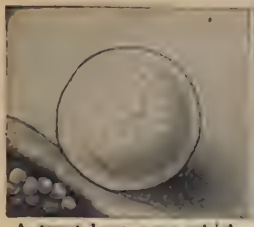
The true Carp was brought to Western Europe, like tea and silk, from China and other parts of Asia. Later it was introduced into American ponds and lakes. Though it thrives, it is not much prized as a food fish, for its flavor is not of the best.

They are intelligent, as fish intelligence goes, and do not take a hook readily. Their indifference to human wiles arises partly from the fact that they live largely on vegetation, but they eat worms, small fishes and other living things. Three children who will read this page remember putting ten thousand tadpoles into a pond where about a hundred golden carp lived, and within a week not a tadpole remained. The goldfish had eaten them.

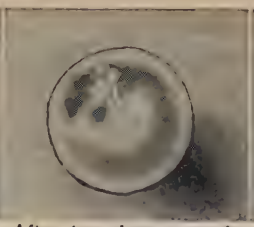
THE BRILLIANT GOLDFISH ARE MEMBERS OF THE CARP FAMILY

For, as we all know, the Goldfish are only carp, the fairest of their tribe, but

PICTURE-STORY OF A TROUT'S LIFE



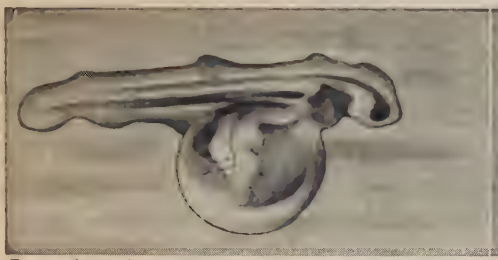
A trout lays eggs which adhere to the under-side of a stone. Here is an egg magnified.



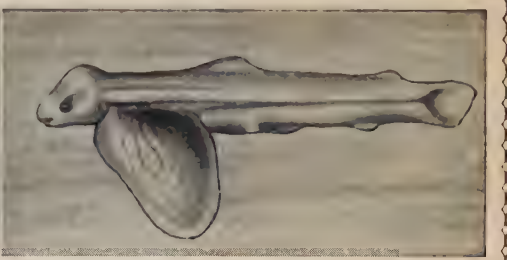
After two days a mark appears in the egg, and this is the beginning of the young trout.

After about two weeks two dark spots appear in the mark, and these will be the eyes.

After about five weeks the appearance of the tiny trout can be distinguished.



Forty days from the time the egg was laid the little trout is hatched. It still has no proper mouth, but lives on the yolk of an elongated sac.



Twelve days after the trout is hatched the sac of yolk is seen to have shriveled owing to the fish living on it.

Here, twenty-four days after the hatching, the sac has almost gone.

About 110 days have now passed since the trout was hatched.

At the end of twelve months the trout is about three inches long, and it is then a perfect miniature of its parents. It feeds on insects, worms and other small creatures, and grows bigger and bigger for several years.

still carp. How they originally came by their exquisite coloring no one knows. We believe them to have been developed by patient human selection, century after century, in China and Japan, from a small dull-colored Oriental species. Now, like new flowers and fruits, like freak pigeons and poultry, they breed true to type, and if we but feed them with sufficient vegetable and animal matter, and give them moderate liberty in a small pond, they sleep beneath the ice in winter, revel in the sun and shade of summer, and in our home waters lay eggs from which come little black carp which in time turn to gold and even to silver hue. In aquariums you can see some of these freak fishes which are highly prized. Some have long drooping tails which hang like plumes. Others have eyes on the end of knobs projecting from their heads. Many strange combinations of red, silver and black are seen.

Length of days is always associated with carp. We know much about them from the fact that in the time of the monasteries the monks bred them in their own ponds. The carp were the Friday diet when meat was forbidden. So we inherit a store of facts about these slow, cunning loiterers through life. They eat well and exhaust little energy, so, like tortoises and turtles, they should live long. And they do. It is said that the great carp still swimming in the lake among the country cottages of Marie Antoinette at Versailles were put there by Marie Antoinette herself. It is believed that this fish may live to be two hundred years old.

Many fish of which you have read in English books belong to the Carp Family, including the barbel; the gudgeon, which is really a lesser species of barbel; the pretty silvery roach; the rudd, that closely resembles it; the chub, which eats not only frogs, but the precious young of trout and salmon; the brilliant little dace; the abounding minnow; the tench, which has been introduced into American waters; bream; bleak; stone loach; and groundling, or spiny loach. All these are carp.

THE FISH WITH THE SHIMMERING SCALES THAT LOOK LIKE PEARLS

Each has its special interest, and to many much beauty is given. The Bleak, with his shimmering scales as bright as mercury, is caught for a strange purpose. Men take off his scales and convert these gleaming morsels into a covering for glass beads which are sold as imitation pearls. Herring-scales serve a similar end.

The tiniest of all the carp is the Minnow, the commonest, gayest, jolliest of all our fishes of inland waters. Insignificant as they are in size, they are of great importance as the food of other fish. A little mother minnow in her prime lays a thousand eggs a year; hence the enormous numbers. Yet, common as they are, they baffle our study in one important particular: they can change color as rapidly as a chameleon—blue, black, purple shades, dusky gold. These changes do not seem to come in order to match surroundings, but with varying emotions—with appetite, with joy at the sight of food, and sometimes, as it seems, for the mere delight of mocking the rainbow. Some of our members of this family are the Squaw-fish, which is really a kind of minnow, in spite of the fact that it is sometimes four feet long. It is common beyond the Rocky Mountains; there are several species of Chub; and the western fish known as the White Salmon, though it is not a salmon at all. The Fallfish is one of the largest of the minnows and is found in the clear swift streams of the East.

The Sucker Family is another large group of small-mouthed fishes almost entirely confined to North America. They seldom take the hook, and are usually caught in seines, or nets. Some of the family are the Buffalo Fish, several species, common in the interior; the Lake Carp (which is not a carp) found in the lakes drained by the St. Lawrence; the Blackhorse of the Mississippi Valley; the Redhorse, which is also found in Atlantic waters, and many others called by different names. Dozens of species are caught, but their food value is lessened by the presence of many tiny bones.

THE FEROCIOUS AND TERRIBLE PIKE, THE OGRE OF THE RIVERS

We come now to a grim native of our waters, the Pike, found in the northern waters of three continents. It is dreaded by all other forms of life. The pike reaches four or five feet in length, with a weight of from seventy to one hundred pounds, according to legend, but certainly fifty pounds.

With its weight are associated great power, huge teeth in the lower jaw, and others in the upper part of the mouth

which curve backward to the throat, so admitting prey but rendering it impossible for them to escape. This produces results like those we see when two snakes meet mouth to mouth. Some fishermen found two pike of practically equal size engaged in a deadly grapple. One was swallowing the other alive, and had got it down as far as the shoulders.

Lurking in the shade, looking like a submerged log, the pike resembles the crocodile. When it makes its dart there is no escape. The prey may be its own young, likely as not; it may be a rat, a water hen, a duck, a dog, a young salmon going seaward. One was seen to seize, first a wild duck, then a wood pigeon, which fell into the water from successive shots from a hunter's gun.

Besides the Common Pike we have several other fishes closely related. The largest is the Muskallunge (the name is spelled in more than a half dozen ways), found in the Great Lakes region. Sometimes it reaches a length of eight feet and weighs a hundred pounds or more. It is a good fighter. It prefers cold lakes, but is sometimes found in streams. Like the pike and its smaller cousins the pickerels, it greedily eats smaller fish.

Now we come to the Salmon Family, which is not very large. It includes the whitefish, the salmon and the trout. Moreover, we must divide the salmon. A European knows only the Atlantic Salmon (*Salmo salar*), but in America the Pacific Salmon (*Oncorhynchus*) is even more important than the Atlantic. We shall speak of them in a moment.

A salmon takes a leap on its way up the river.

The Whitefish are among the most important American fresh-water fish. There are nearly twenty species, but the Common Whitefish of the Great Lakes region is the most important. It lives in deep water, but comes to the shallows to spawn. As a female may lay 75,000 eggs, it is easy to see that but for the many other fish that eat the eggs the number would soon fill the lakes. In order to keep up the numbers the governments of Canada and of the United States distribute millions of young whitefish every year. Several other species are important, and also the so-called Lake Herring, or Cisco, should be mentioned. Its habits are much the same as its larger relative, though it is much smaller.

Both the Atlantic and the Pacific salmon spend a large part of their lives in the sea, and come up the rivers chiefly to spawn. They are called anadromous fish, from the Greek word which means "ascending." It is commonly believed that they return to the same water they were hatched in, but this is not proved.

Let us first speak of the Atlantic Salmon. This fish was much prized by the Roman conquerors of Gaul and Britain two thousand years ago. The Normans valued them highly, and when John Cabot came to explore the new continent he was pleased to recognize his old friends in the waters of Newfoundland. He found that the Indian had learned to spear them as they ascended the rivers. How far north they go we do not know. They are found in all Northern European waters, in Greenland and Labrador.

Once they were more common than now, and we are told that long ago in Scotland and also in Connecticut servants demanded that they should not be required to eat salmon more than twice a week. In these days fresh salmon is a luxury.

Soon after the fish enters the river the silvery color seems to tarnish. The lower jaw of the male grows and grows, until a formidable hook-like process is established in front. The fierce-seeming hook is not a weapon of offense, though the males battle ferociously for their mates, and death sometimes happens when a greater salmon fights a smaller. That beak is not bone, but cartilage, therefore not deadly, as it seems. The great salmon can fight, and yet not kill one another. But the great swim is in progress, up and up the stream. Its yearly stay in the river may amount to four or five months, and it has long been believed that in all that time the salmon took no food! We are told that the reason salmon were caught with artificial flies and other baits was curiosity.

It is very difficult to learn the habits of fishes, but recently naturalists have come to doubt this story. Some believe that in America, at least, the salmon that enter the rivers in the spring come in search of food and perhaps return to the sea. When they again enter the rivers in the fall they do not seem to eat.

Falls and dams do not deter the salmon. So long as there are points in the ascent not more than six feet apart he will get up, leap by leap. Of course salmon make mistakes and sometimes jump out on to the bank.

THE ARRIVAL AT THE GOAL AND THE RETURN TO THE SEA

At last the head of the stream is reached, and there the final battles are fought between the males. The females lay their eggs in hollows wriggled out by themselves in the gravel; then all turn their heads downstream and float out to sea, gaunt spectres of their earlier selves and worth no man's while to catch. In the ocean their feasting will be renewed, their fat and splendor restored, and in due time they will make another journey inland.

The eggs hatch in from thirty days of mild temperature to five months in cold weather. The young stay for their first two years in the river, but at the end of that time they drop downstream in millions, grow great and strong, then return from the sea. There are salmon, however, which do not go to sea. The Sebago, or Landlocked Salmon, first found in Maine, and the Ouananiche of Canada are true salmon which live all their lives in fresh water. Some students of fishes deny that they are really separate species, so much are they like the Atlantic salmon. Anglers say that the Ouananiche is the gamest of all fish.

THE STRANGE FATE OF THE PACIFIC SALMON

The story of the Pacific Salmon is not quite the same. Like the Atlantic salmon, it ascends the rivers, leaping falls if necessary; the males fight; the nest is dug in the gravel and the eggs, covered in, are left to hatch; but the parents never return to the sea alive, and the young do not remain in the river.

Five species are found in American waters and another in Japan. The Chinook, or Quinnat, which sometimes weighs a hundred pounds, is most valued, and the Blueback, or Sockeye, next; but the Humpback, the Silver and the Dog Salmon are also taken in considerable quantities. Only a small part of the catch is eaten fresh. From Alaska southward to California are many canneries which pack the fish and send it all over the world.

The habits of the Chinook have been carefully studied. As they sometimes must travel a thousand miles to the headwaters of the streams they frequent, they enter the rivers in early spring and swim leisurely upward. They will not spawn until the temperature of the water is about 54° or lower. If the water is too warm when they arrive, they loaf until the temperature falls. Finally a hole is dug in the gravel, the eggs are deposited during several days, and then are covered. When spawning is completed, the old fish die and float downstream, furnishing food for birds and animals.

Depending somewhat upon the temperature of the water, the eggs hatch in from four to six months, and as the young grow they make their way downstream into the ocean or the bays and sounds. It is now believed that they do not go so far from the shore as had been supposed.

THE MANY SPECIES OF TROUT IN THE WORLD

Many different American fishes are called trout. Though all, or nearly all, belong to the Salmon Family, we have at

least three genera and many species. Many of their habits are like those of the salmon, and a few go to sea, though most of them spend their lives in fresh water.

Strange to say, those most closely allied to the Atlantic salmon (*Salmo salar*) are found in lakes and streams in the western half of the continent. There are twenty or more species, such as the Steelhead, the Rainbow, the Salmon, the Golden, and many others.

In the Great Lakes are found two large trout of a different genus. The Great Lakes Trout has been known to weigh 125 pounds. It is usually taken in nets, and the value is considerable. Another form, the Siscowet, is less liked.

Most of the Eastern trout, as well as the European trout, are charrs, belonging to the genus *Salvelinus*. The most famous is the Brook, or Speckled, Trout, beloved of all fishermen. It is one of the most beautiful of fish, and has been introduced into many streams. The Dolly Varden is found only in Pacific waters, and is sometimes called Salmon Trout. Then there are the Sunapee Trout, the Blueback, and others. The European Brook Trout has also been introduced. All of these are loved by the fisherman, who feels that it is unsportsmanlike to take any of them except with the artificial fly. The streams of the East are so much fished that the supply must be kept up by artificial hatching.

The Eel never fails to fascinate us. It is born, over a thousand feet deep in the warm Atlantic, thousands of miles at sea, yet it swims slowly to some destined riverway, bay or inland pond. Countless millions of the fry ascend the rivers at a time. It has been noted that at the foot of Niagara Falls in spring and early summer hundreds of wagon-loads may be seen crawling over the slippery rocks.

They swim up the streams, they climb with wriggling gait through sluices, they ascend the banks and wriggle their way inland to ponds, pools and ditches and even to wells which they have never seen. It is not a fact that they make all their land journeys through dewy grass; eels have been seen which have crossed gravel, macadam, or heavy jagged slag to reach an inland pond in a field two or three miles away from a river.

For six, seven or ten years the eels grow up in these streams and ponds; then out they go, back by the way they came, over rough ways and smooth, moist ways and dry, to the river, down to the open sea, and then straight out to sea. Both European and American eels seem to spawn south of the Azores. Then they die.

It is estimated that a large eel will lay at least ten million eggs. From those that hatch come creatures entirely unlike eels. They had until late years always been mistaken for a sort of ribbon fish, for they do not look like eels. The head is small and tubular, with projecting teeth, but the body is flattened.

As soon as they are able to travel, the cousins part, the American turning west and making for the New World; the others turning east and beginning a long voyage to Europe. At first they grow readily in the flattened shape, but feeding brings a change. They alter as remarkably as a tadpole. The head does not grow, but the body diminishes to match its size, and takes on a cylindrical shape.

When the change begins in the deep sea the little eels are three inches or more long, but they fast while the transformation is in progress, and measure but two inches on entering the rivers, weighing about 1,500 to the pound.

THE LONG, LONG JOURNEY TO THE UNKNOWN INLAND WATERS

Until recently the spawning of the eel has been a mystery; and it is to a patient Danish scientist, Dr. Johannes Schmidt, that we owe the final solution. We know the rivers from which the adults set out and to which the young return, but it has to be added that the time of the returning is not the least astonishing feature of this amazing story. Every baby eel has been for more than a year slowly navigating from the depths beyond the Azores to the stream from which it is to climb into some distant ditch or pond. There they will remain, eating fishes and little frogs, carrion or insects, until their time comes to make the great voyage. Though eels are valuable for food, fishermen hate them because they eat so many other fish.

These are not all of the fishes of our rivers and lakes, but they are the most important. As we have several hundred species of fishes which are good for food, you can see that we cannot describe them all without using a whole volume. The other fishes which live in the sea but visit rivers are described in the next story.

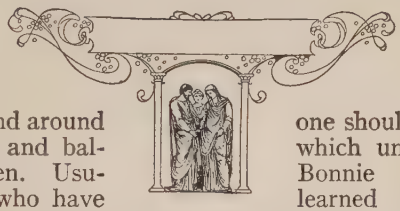
THE NEXT STORY OF ANIMAL LIFE IS ON PAGE 5773.

"PRINCE CHARLIE," THE YOUNG PRETENDER

Charles Edward Stuart, the grandson of James II of England, was known to his followers as "Bonnie Prince Charlie," while his enemies called him "the Young Pretender." His father before him had attempted to regain the British throne, from which his grandfather had been driven, and the young man himself, in the year 1745, went over from his refuge in France to place himself at the head of his faithful followers in Scotland and to descend upon England in a final effort for his lost throne. The story of this unhappy uprising is told in Sir Walter Scott's great romance of Waverley. This painting of Bonnie Prince Charlie and two of his followers is by John Pettie, R.A.
Photographed by Caswall Smith.

The huts of the crofters on the Isle of Skye, which sheltered Prince Charles.

BONNIE PRINCE CHARLIE



IN all ages there have been great men and women whose praises have been sung by bards, and around whose names legends and ballads have been woven. Usually, however, those who have been honored were great in deed or thought. It is the more surprising, then, to find that the hero of a cycle of songs which began almost two hundred years ago and has grown in popularity ever since, was really a failure. This hero was Prince Charles Stuart, the last of the royal Stuarts, once rulers of Scotland and later of Great Britain, about whom you may read on page 1973.

Wherever the English tongue is spoken "Bonnie Prince Charlie" is a familiar name among educated people. Even among uneducated people are heard songs centring in that ill-fated prince. It is extraordinary that such has been the case, and that a lost cause and a defeated leader have been so vividly remembered. The romance of the Jacobite Rebellion of 1745–46, undertaken against such tremendous odds, the charm of the handsome young Stuart and the intense loyalty, love and sacrifice of the Highlanders of Scotland are the subjects of hundreds of songs which to-day stir the hearts of millions who cannot boast Scottish blood. For that reason everyone should know the true story which underlies the legend of Bonnie Prince Charlie. We learned on page 1981 that James II had been forced to give up the throne of Great Britain in 1688. He betook himself to France with his only son, James Francis. Thirteen years later he died. Prince James, the son, made several attempts to claim the British throne without success. By many people he was called "the Old Pretender."

In 1719 he married Maria Clementina Sobieski, the youngest of three daughters of Prince James Sobieski, whom Austria had tried in vain to set on the throne of Poland. They were well mated, those two royalties, in that they both were without kingdoms, and for some years they were happy. Their first home was the Palazzo Muti, a dreary old palace in the older part of Rome. And there it was that Charles Edward Louis Philip Casimir Stuart—the future "Bonnie Prince Charlie"—was born on December 31, 1720. Great was the rejoicing in Rome and among Jacobites all through Europe. Astrologists said that the Heavens themselves had foretold the birth, and

that the future of the newborn prince would be dazzlingly glorious. The baby was baptized by the pope in person.

Almost five years later a second son, Henry Benedict, was born. This boy eventually became Cardinal York. Shortly after Henry's birth Clementina left James and went to a convent, where she died ten years later.

So much for Prince Charles's parents, neither of whom had much influence on his upbringing or the molding of his ideas. At three years of age the young prince was described as "the finest child in the world, healthy and strong; speaks everything—and runs about from morning till night." At seven he rode well, was an excellent shot, a good tennis player and an excellent dancer. He could read and speak English, French and Italian, and knew his catechism. It is no wonder that all those who saw him then thought him brilliantly clever, with royal gifts that promised well for his future.

THE PRINCE'S EDUCATION WAS SADLY NEGLECTED

But unfortunately his tutor, Ramsay, had been sent away before Charles was five years of age, and the boy's education was intrusted to Sir Thomas Sheridan. Sheridan neglected his pupil entirely, and it is safe to say that under him the young Stuart learned nothing. That is the reason Charles in later life could not spell. His letters which have come down to us show that he narrowly escaped being illiterate. His French letters were equally misspelled and more ungrammatical. His musical education, however, made him an excellent performer on the bass viol.

If the young prince did not care for study, he did care for sport and exercise. He had none of the lazy habits of his Roman friends, and as often as possible he went out to distant forest estates to shoot game or stick the boar. On these excursions he wore Highland dress and went shoeless to harden his feet. It is said, too, that he insisted upon eating simple and somewhat rough food to accustom himself to Highland diet.

At the age of fourteen he had his first taste of warfare when he was present at the siege of Gaeta. His cousin, the Duke di Liria, took him on that expedition. It was at this time that Charles assumed the traveling name of the Chevalier de St. George, and as the "Young Chevalier" he has figured in many a song and story.

THE PRINCE GROWS INTO A HANDSOME YOUNG MAN

Three years later Charles had grown into a handsome young man. He was nearly six feet tall, slight, but muscular and robust, and endowed with unbounded energy and courage. His face might well have been his fortune, for he was very good to look upon. Golden chestnut hair waved above a broad and high brow. Well-set brown eyes, a clear complexion, a shapely nose and a smiling mouth earned for him the endearing nickname "Bonnie Prince Charlie." At this time his father sent him to visit the Italian courts, where he was flattered and made much of. His charm of manner won him many friends, for he could be fascinating in his courtesy. On the other hand, he could be equally rude to those who bored or crossed him.

Court life did not appeal to this young Stuart, who was not interested in the ladies nor in the effeminate amusements of the men. Already the last of the Stuarts had turned his thoughts toward the possibility of recovering the throne of his forefathers. Prince James had tried to oust the Hanovers from the British throne, but that failure did not discourage the son.

THE SCOTS ARE LOYAL TO THE STUART FAMILY

All the while in Scotland there were loyal Highlanders and Lowlanders as well who ever hoped for the return of the Stuarts. Resentment burned fiercely against the German occupant of the British throne and his followers. Claymores were loosened in their scabbards and hot speech stirred the hearts of those who hated the new royal house.

> Scotland is owre cauld a hole
> To harbour siccan vermin,
> But the very dogs of the English court
> Go "Bow! wow! wow!" in German.

These are the words of an old Jacobite song, The Wee Wee German Lairdie, which bears witness that Scots did not scruple to use harsh words to express their scorn when they hated. Nor did they stint themselves of tender words when they loved. The Standard on the Braes o'Mar, "When the king comes o'er the water," Bonnie Dundee, and "There'll ne'er be peace till Jamie comes hame," are songs of that period when James was expected to claim the crown which his father lost. In secret men and women toasted the

absent Stuart by name. In public they did it by passing their wineglasses above vessels containing water—thus drinking "to the king across the water."

PREPARATIONS ARE MADE FOR AN UPRISING

In the poor cottage of the peasant and in the castle of the noble alike were found men and women willing to risk their all for an ideal and in whose thoughts loyalty, liberty and the Stuart cause were combined. But "Jamie the Rover," as Prince James was called, did not succeed in gratifying their hopes.

As Charles Stuart grew to manhood glowing reports about him began to spread throughout Scotland. From the border to the far-northern islands swept a wave of tender feeling for "the lad who was born to be king." Plots and schemes of all kinds were set on foot to bring the Prince to Scotland; money was collected to buy arms for an uprising. Maclean's Welcome is a martial song giving an idea of the feeling widely prevalent in the land.

Come o'er the stream, Charlie,
Dear Charlie, brave Charlie,
Come o'er the stream, Charlie,
And dine with Maclean.
If aught will invite you,
Or more will delight you,
'Tis ready, a troop of our bold Highlandmen,
All ranged on the heather,
With bonnet and feather,
Strong arms and broad claymores,
Three hundred and ten!

Charles was eager to test his fortune, but his opportunity did not arrive until the year 1745. He had tried to cross the Channel the previous year, but the expedition which France had prepared to aid him was met by British ships and turned back. For nine months the Prince waited in France for further aid from the French, but it was refused him. His Scottish supporters also discouraged him from making another attempt just then. But Charles grew desperate, and determined to land on Scottish soil if he had to go "with a single footman."

BONNIE PRINCE CHARLIE REACHES SCOTLAND

On June 22, 1745, he set sail from Nantes in the small brig La Doutelle, with seven companions, the "Seven Men of Moidart," as they are commemorated in song. A French man-of-war with munitions accompanied the brig, but, unfortunately for Charles, she was set upon by a British frigate and had to flee. The Prince landed on the island of Eriskay on a stormy night and was given shelter in a miserable hovel where he had to help cook the fish he and his companions were able to catch. The accommodation was so limited that he had to share a bed with someone else. But he was safe from spies and enemies.

Such was the humble beginning of his great adventure. But the Young Chevalier was not daunted, for he was in the country of his supporters, the Macdonalds of Clanranald and Glencoe, the Macdonnells of Glengarry and Keppoch, the Camerons of Lochaber, the Stewarts of Appin, and the Macleans of Ardgour and Mull.

At first the older men of the Macdonald clan cautioned delay, but the Stuart charm overcame their scruples. They decided to push forward an uprising. Cameron of Lochiel followed suit, and the fiery cross was sent out through the Highlands to call gentles and commons to the Stuart banner.

Rouse, rouse, ye kilted warriors,
Rouse, ye heroes of the North!
Rouse, join your chieftains' banners!
'Tis your Prince who calls you forth!
Shall we basely crouch to tyrants,
Shall we own a foreign sway,
Shall a royal Stuart be banished,
While a stranger rules the day!
Wha wouldna fecht for Charlie,
Wha wouldna draw the sword,
Wha wouldna up and rally
At the Royal Chieftain's word!

Despite the fact that the British Government had placed a reward of $150,000 upon Charles's head, the hills echoed to the strains of clan gatherings as the pipes played thousands of clansmen to the meeting-place. Early in September the Prince, at the head of 4,000 men set out for Edinburgh, and on the seventeenth of that month he entered the historic city. There was little opposition except from the stern old fortress on the heights which was in the possession of Hanoverian troops. However, the heralds, in old-time finery, proclaimed King James II and Charles Prince Regent from the City Cross. A state ball was held in Holyrood Palace, and high celebration and rejoicing took place.

Meanwhile General John Cope was marching on the city with 3,000 men. Charles knew that he could not defend Edinburgh against attack, so he set out with his army to meet the Englishman.

Thanks to a night raid, the Highlanders put Cope's army to rout. The victory is still fresh in Scottish memory, for "Hey Johnny Cope" is sung to this day. Elated by his success, Charles returned to Edinburgh.

THE JACOBITE ARMY INVADES ENGLAND

Had the next step been different, history might have recorded another story, but in a fatal moment it was decided to invade England and march on London. In the Scottish hills Charles might have held the English at bay and eventually might have won his throne, but it was not to be. Early in November the Jacobite army crossed the border, captured Carlisle, and marched on Derby, in Lancashire. But the expected support from Stuart supporters in England did not arrive, and, in addition, the Duke of Cumberland, known as "Butcher" Cumberland, was put in command of the English troops to attack Charles. There was nothing for it but to retreat. The tide of the Stuart fortunes had begun to turn.

The morale of the Stuart supporters was breaking as the army retreated through Glasgow to Stirling. There more troops joined the Prince and were successful in smashing the advance of an English army under Hawley. But Cumberland was advancing, so, much against the wish of the Prince, a decision was made to retreat across the Forth into the Highlands. On March 3 another British army, under Loudon, was beaten at Moy, and the Highland forces captured Inverness Castle. That was the last Stuart success.

Events now began to forecast the illluck that dogged the Prince until the fatal day of Culloden. The sloop Prince Charles, bringing men, military stores and money from France, was driven ashore and captured by the English. The siege of Blair Castle had to be abandoned by the Jacobites, as Hessian troops were approaching. Many of the crofters left for their homes to sow the crops so that their families would not starve, and this reduced the number of Charles's supporters to 5,000.

THE NET CLOSES ON THE DEVOTED HIGHLANDERS

On April 8 Cumberland left Aberdeen with 9,000 of England's best-trained troops. A week later this third son of George II, and Charles's own cousin, celebrated his birthday at Nairn, and his army was allowed to drink heavily. The Jacobites planned to take advantage of the condition of the English army by launching an attack that night. A forced march of eight miles was to be made from Culloden, and the drunken English soldiers were to be surprised as they celebrated or slept. But the rear guard of the Highland army was delayed, and when the van came into touch with Cumberland's men daylight was appearing. The attack had failed, and a retreat was made to the camp at Culloden House.

The Highland men were exhausted from lack of food and continued hardship, but Cumberland, pushing rapidly behind them, did not grant them an opportunity of resting or eating. At eleven o'clock in the morning on April 16 the two armies faced each other on the moorland plateau between Culloden Parks and the river Nairn. Cumberland's army was well fed and fresh; Charles's army was hungry and exhausted, and was woefully outnumbered. Cluny Macpherson with his clansmen was absent in Badenoch, so Lord George Murray counseled a retreat to the hills until his arrival. The French ambassador implored Charles not to give battle, but it was too late. The English cannon began to wreak terrific damage on the Jacobite host, and the Highlanders had no artillery with which to answer. In desperation at their increasing losses the Mackintoshes charged forward across cannon-swept space between the armies. With pipes shrilling the pibrochs, the other clans followed, and so determined was their onrush that Cumberland's first line was broken. But a withering musket-fire from the rear ranks of the English troops mowed down the Scots. Most of the chiefs were killed and hundreds of their followers. What remained of the Prince's army broke and fled. The death-blow had been given to the hopes of the Stuarts. Charles was taken in charge by his Life Guards, a body of Lowland gentlemen, but he left them secretly, and sending word for them to look out for their own safety, he set out for the hills with a few followers.

THE PRINCE IS HUNTED FOR FIVE MONTHS

For five weary months the last of the Stuarts was a hunted man, owing his safety to the feeling of personal loyalty, love and honor of the Highland people. Poor as these clansfolk were, they never

considered the huge reward offered by the British Government for the capture of Charles: Charles was their prince, their friend and their guest; to protect him and keep his hiding-places secret the Highlanders faced death or loss of liberty unhesitatingly. The sad flight of the "fair-haired laddie" brought out all the tenderness of the mountaineers, and it is this period of Charles's life that gave inspiration for so many moving and sorrowful ballads and songs. One of the best known is:

WAE'S ME FOR PRINCE CHARLIE

"On hills that are by right his ain
He roams a lanely stranger;
On ilka hand he's pressed by want,
On ilka side by danger.
Yestreen I met him in the glen,
My heart near bursted fairly;
For sadly changed indeed was he—
Oh! wae's me for Prince Charlie!

"Dark night cam on, the tempest howled
Out owre the hills and valleys;
And whar was't that your prince lay down
Whase hame should been a palace?
He row'd him in a Highland plaid
Which covered him but sparely,
And slept beneath a bush o' broom—
Oh! wae's me for Prince Charlie!"

From Culloden, Charles, guided by Edward Burke, struck out for Gortuleg, but finding no safety there, pushed on to Invergary, Arisaig and Borrodale. At the last-named place Donald Macleod, a crofter, met him to guide him to the outer islands. Had Charles waited a few days in Borrodale he would have been rescued by French ships, but by that time he was sailing among the islands in search of a safe shelter. Sleeping on the bare ground, living on dried fish and cold brandy punch, the Prince was driven from island to island as the English closed in on his band. However, the royal fugitive did not suffer in health or spirits.

FLORA MACDONALD DETERMINES TO AID THE PRINCE

Early in June Charles met Lady Clanranald at Armadale, in South Uist, and two weeks later the Prince was introduced by that lady to Flora Macdonald. Flora, who was two years younger than Charles, was the only daughter of Ranald Macdonald, of Milton. Her father died when she was two years old, and her mother married again, but Flora was practically adopted by Lady Clanranald. She was a person of rare charm and much ability. In appearance she was rather like Charles, in a smaller, finer mold. Lady Clanranald had waked her romantic sympathy for the Prince, and she determined to find some means of helping him to leave the island of South Uist.

Her stepfather was a captain of militia, and from him she obtained a pass for herself, a manservant and a maidservant, to Skye. The Prince, dressed in a calico gown, a brown mantle and a large hood became "Betty Burke," the maidservant. On the night of June 28 the three sailed for Skye in a boat manned by Macdonalds. The Little Minch was very stormy, but the attempt had to be made before any suspicions were aroused. It is that journey which made the name of Flora Macdonald famous throughout the world. One of the most loved songs which every Scot sings is "Over the sea to Skye," which is given here in full.

"Speed, bonny boat, like a bird on the wing,
Onward," the sailors cry;
"Carry the lad that's born to be king,
Over the sea to Skye!"

Loud the winds howl, loud the waves roar,
Thunder-clouds rend the air;
Baffled, our foes stand by the shore;
Follow, they will not dare.

Though the waves leap, soft shall ye sleep:
Ocean's a royal bed:
Rocked in the deep, Flora will keep
Watch by your weary head.

Many's the lad fought on that day
Well the claymore could wield,
When the night came, silently lay
Dead on Culloden's field.

Burned are our homes, exile and death
Scatter the loyal men;
Yet ere the sword cool in the sheath
Charlie will come again.

Next day the boat was shot at by soldiers and chased for miles, but a safe landing was made near Sir Alexander Macdonald's estate in Skye. Flora and Lady Macdonald threw the soldiers off the scent and Charles was hidden in the house of Macdonald of Kingsburgh, where he was entertained royally. The following morning the Prince was roused, and after bidding Flora farewell and giving her a lock of his hair, he set out for Portree.

FLORA MACDONALD REMOVES TO NORTH CAROLINA

Flora Macdonald never saw him again. She was arrested and taken to London, where she was condemned to a nominal

imprisonment for her share in the escape. There she was visited by the English nobility and by the Prince of Wales. She charmed everyone who met her, and many were the offers of marriage made to her by men of great title. But she returned to Skye and married her cousin, Allan Macdonald of Kingsburgh, a very gallant Highlandman.

Just before the American Revolution Flora and her husband removed to North Carolina, where there was a considerable Highland settlement near the present town of Fayetteville. When the royal governor called the Loyalists to arms, Allan Macdonald raised a force of Highlanders, but was severely defeated at Moore's Creek, February 27, 1776, and was taken prisoner. When released, he and Flora returned to Scotland. They had suffered from loyalty to both Stuart and Hanover. Though she was a Loyalist, the people of North Carolina are proud that Flora Macdonald lived for four years in the state, and a college for women has been named in her honor.

The legend that has grown up concerning a romantic attachment between Charles and Flora had no foundation in fact. Only on four or five occasions did she see the Young Chevalier, and there is no record that he even wrote to her after he left Scotland.

CHARLES AT LENGTH MAKES HIS ESCAPE FROM SCOTLAND

Charles had far to go and much to suffer after his escape to Skye. Still hunted fiercely, he reached the mainland once more and was sheltered by the Macdonalds and Camerons, themselves hunted men. Dodging among the mountains, sleeping out in storms and rain, a little band of men with prices on their heads slipped through the English troops to the north. At Poolewe they found the French ships had come and gone. After hairbreadth escapes they turned south once more, and Charles reached a haven in the noted cave of Cluny Macpherson. Three weeks later Charles and Cameron of Lochiel embarked on the French privateer L'Heureux for France, and nine days later they landed in Brittany. Charles was met by his brother Henry and by several noblemen who conducted him to the king of France, who congratulated him on the heroic qualities he had displayed.

It was through no lack of courage that Charles had lost his desperate venture. But there had been no preparation for the uprising: money and munitions were absent, and there had been much bad management and misunderstanding. The English Government, however, determined to make an example of those who had aided the Prince, and took cruel, harsh measures to break up the clan system. The Jacobite chieftains were forced to flee the country with many of their followers, and their estates were confiscated. The Duke of Cumberland hanged men without mercy. The next few years were sad and bitter in the Highlands.

SONG AND STORY GROW UP AROUND HIS MEMORY

Perhaps such persecution increased the tenderness which the Highlanders felt for the last of the Stuarts, because a wealth of song and tradition was built up around those fateful days of 1745–46. And it steadily increased. Wherever Scots found refuge memories were kept fresh and tales were handed down from generation to generation. There were hopes that another attempt would be made to establish Charles on the British throne, and such hopes are voiced in a song that is heard wherever the English tongue is spoken.

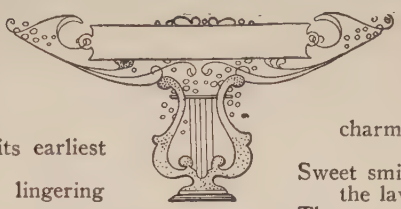
Will ye nae come back again,
Will ye nae come back again—
Better loved ye ne'er can be—
Will ye nae come back again?

There is little to relate about the rest of the Young Chevalier's life. He became an embittered man and wandered forlornly around Europe for years. He had one daughter by Clementina Walkinshaw. Later he married an Austrian princess. But both women left him because he mistreated them shamefully. Toward the end of his life he reformed, and his daughter Charlotte came to the Palazzo Muti to care for him. Charles Stuart died in Rome on January 31, 1788. His daughter died a year later as a result of a fall from a horse. Cardinal York, who had made no claim to the British throne, lost all his money when the French invaded his benefices, but George III of England made him a substantial allowance. When he died, in 1807, the direct Stuart line was extinct. The last three of the royal Stuarts lie buried in the crypt of St. Peter's at Rome.

THE NEXT STORY OF MEN AND WOMEN IS ON PAGE 5699.

THE Deserted Village, She Stoops to Conquer, The Traveler, and The Vicar of Wakefield are the best-known works of Oliver Goldsmith, author, poet and playwright. Born in Ireland in 1728, he went to Trinity College, Dublin, in his sixteenth year, but was too idle and pleasure-loving to shine as a scholar. After leaving college he wandered through Europe, earning his bread and lodging by playing "merry tunes" on his flute. At about the age of thirty he settled in London and began to write. As his fame grew he became acquainted with Johnson, Reynolds, Burke and other great men of the time. He was always getting into scrapes, yet he was so lovable that many of the prominent men of his day were his devoted friends.

THE DESERTED VILLAGE



SWEET Auburn! loveliest village of the plain,
Where health and plenty cheered the labouring swain,
Where smiling spring its earliest visit paid,
And parting summer's lingering blooms delayed.—
Dear lovely bowers of innocence and ease,
Seats of my youth, when every sport could please:
How often have I loitered o'er thy green,
Where humble happiness endeared each scene!
How often have I paused on every charm—
The sheltered cot, the cultivated farm,
The never-failing brook, the busy mill,
The decent church that topped the neighbouring hill,
The hawthorn-bush, with seats beneath the shade,
For talking age and whispering lovers made!
How often have I blest the coming day,
When toil remitting lent its turn to play,
And all the village train, from labour free,
Led up their sports beneath the spreading tree:
While many a pastime circled in the shade,
The young contending as the old surveyed;
And many a gambol frolicked o'er the ground,
And sleights of art and feats of strength went round:
And still, as each repeated pleasure tired,
Succeeding sports the mirthful band inspired;
The dancing pair that simply sought renown,
By holding out, to tire each other down;
The swain mistrustful of his smutted face,
While secret laughter tittered round the place:
The bashful virgin's sidelong looks of love,
The matron's glance that would those looks reprove,—
These were thy charms, sweet village! sports like these,
With sweet succession, taught e'en toil to please;
These round thy bowers their cheerful influence shed,
These were thy charms—but all these charms are fled.

Sweet smiling village, loveliest of the lawn,
Thy sports are fled, and all thy charms withdrawn;
Amidst thy bowers the tyrant's hand is seen,
And desolation saddens all thy green;
One only master grasps the whole domain,
And half a village stints thy smiling plain;
No more thy glassy brook reflects the day,
But, choked with sedges, works its weedy way;
Along thy glades, a solitary guest,
The hollow-sounding bittern guards its nest;
Amidst thy desert-walks the lapwing flies,
And tires their echoes with unvaried cries.
Sunk are thy bowers in shapeless ruin all,
And the long grass o'ertops the mouldering wall;
And, trembling, shrinking from the spoiler's hand,
Far, far away thy children leave the land.

Ill fares the land, to hastening ills a prey,
Where wealth accumulates, and men decay:
Princes and lords may flourish, or may fade;
A breath can make them, as a breath has made;
But a bold peasantry, their country's pride,
When once destroyed, can never be supplied.

A time there was, ere England's griefs began,
When every rood of ground maintained its man,
For him light labour spread her wholesome store,
Just gave what life required, but gave no more:
His best companions, innocence and health;
And his best riches, ignorance of wealth.

But times are altered: trade's unfeeling train
Usurp the land and dispossess the swain;
Along the lawn, where scattered hamlets rose,
Unwieldy wealth and cumbrous pomp repose,
And every want to luxury allied,
And every pang that folly pays to pride.
Those gentle hours that plenty bade to bloom,
Those calm desires that asked but little room,
Those healthful sports that graced the peaceful scene,
Lived in each look, and brightened all the green,—
These, far departing, seek a kinder shore,
And rural mirth and manners are no more.

Sweet Auburn! parent of the blissful hour,
Thy glades forlorn confess the tyrant's power.
Here, as I take my solitary rounds,
Amidst thy tangling walks and ruined grounds,
And, many a year elapsed, return to view
Where once the cottage stood, the hawthorn grew—
Remembrance wakes, with all her busy train,
Swells at my breast, and turns the past to pain.

In all my wanderings round this world of care,
In all my griefs—and God has given my share—
I still had hopes my latest hours to crown,
Amidst these humble bowers to lay me down;
To husband out life's taper at the close,
And keep the flame from wasting, by repose;
I still had hopes—for pride attends us still—
Amidst the swains to show my book-learned skill,
Around my fire an evening group to draw,
And tell of all I felt, and all I saw;
And, as a hare, whom hounds and horns pursue,
Pants to the place from whence at first she flew,
I still had hopes, my long vexations passed,
Here to return—and die at home at last.

. . . . . .

Sweet was the sound, when oft at evening's close,
Up yonder hill the village murmur rose;
There, as I passed with careless steps and slow,
The mingling notes came softened from below;
The swain responsive as the milkmaid sung,
The sober herd that lowed to meet their young,
The noisy geese that gabbled o'er the pool,
The playful children just let loose from school;
The watch-dog's voice that bayed the whispering wind,
And the loud laugh that spoke the vacant mind,—
These all in sweet confusion sought the shade
And filled each pause the nightingale had made.
But now the sounds of population fail,
No cheerful murmurs fluctuate in the gale,
No busy steps the grass-grown footway tread,
For all the blooming flush of life is fled—
All but yon widowed, solitary thing,
That feebly bends beside the plashy spring;
She, wretched matron—forced in age, for bread,
To strip the brook with mantling cresses spread,
To pick her wintry fagot from the thorn,
To seek her nightly shed, and weep till morn;
She only left of all the harmless train,
The sad historian of the pensive plain!

Near yonder copse, where once the garden smiled,
And still where many a garden-flower grows wild;
There, where a few torn shrubs the place disclose,
The village preacher's modest mansion rose.
A man he was to all the country dear,
And passing rich with forty pounds a year;
Remote from town he ran his godly race,
Nor e'er had changed, nor wished to change, his place;
Unskillful he to fawn, or seek for power,
By doctrines fashioned to the varying hour;
Far other aims his heart had learned to prize—
More skilled to raise the wretched than to rise.
His house was known to all the vagrant train.
He chid their wanderings, but relieved their pain;
The long-remembered beggar was his guest,
Whose beard descending swept his aged breast;
The ruined spendthrift, now no longer proud,
Claimed kindred there, and had his claims allowed;
The broken soldier, kindly bade to stay,
Sate by his fire, and talked the night away;
Wept o'er his wounds, or, tales of sorrow done,
Shouldered his crutch, and showed how fields were won.
Pleased with his guests, the good man learned to glow,
And quite forgot their vices in their woes;
Careless their merits or their faults to scan,
His pity gave ere charity began.

Thus to relieve the wretched was his pride,
And e'en his failings leaned to Virtue's side;
But, in his duty prompt at every call,
He watched and wept, he prayed and felt for all;
And, as a bird each fond endearment tries,
To tempt her new-fledged offspring to the skies,
He tried each art, reproved each dull delay,
Allured to brighter worlds, and led the way.

Beside the bed where parting life was laid,
And sorrow, guilt, and pain, by turns dismayed,
The reverend champion stood. At his control
Despair and anguish fled the struggling soul;
Comfort came down the trembling wretch to raise,
And his last faltering accents whispered praise.

At church, with meek and unaffected grace,
His looks adorned the venerable place;
Truth from his lips prevailed with double sway,
And fools, who came to scoff, remained to pray.
The service past, around the pious man,
With steady zeal, each honest rustic ran;
E'en children followed with endearing wile,
And plucked his gown, to share the good man's smile.
His ready smile a parent's warmth expressed,

Their welfare pleased him, and their cares distressed;
To them his heart, his love, his griefs were given,
But all his serious thoughts had rest in heaven.
As some tall cliff, that lifts its awful form,
Swells from the vale, and midway leaves the storm;
Though round its breast the rolling clouds are spread,
Eternal sunshine settles on its head.

Beside yon straggling fence that skirts the way,
With blossomed furze unprofitably gay,
There in his noisy mansion skilled to rule,
The village master taught his little school;
A man severe he was, and stern to view,
I knew him well, and every truant knew:
Well had the boding tremblers learned to trace
The day's disasters in his morning face;
Full well they laughed with counterfeited glee
At all his jokes, for many a joke had he;
Full well the busy whisper, circling round,
Conveyed the dismal tidings when he frowned—
Yet he was kind, or if severe in aught,
The love he bore to learning was in fault.
The village all declared how much he knew;
'Twas certain he could write, and cipher too;
Lands he could measure, terms and tides presage—
And e'en the story ran that he could gauge;
In arguing too, the parson owned his skill,
For e'en though vanquished, he could argue still,
While words of learnèd length and thundering sound
Amazed the gazing rustics ranged around;
And still they gazed, and still the wonder grew
That one small head could carry all he knew.

But passed is all his fame: the very spot,
Where many a time he triumphed, is forgot.
Near yonder thorn, that lifts its head on high,
Where once the sign-post caught the passing eye,
Low lies that house where nut-brown draughts inspired,
Where grey-beard mirth and smiling toil retired,
Where village statesmen talked with looks profound,
And news much older than their ale went round.
Imagination fondly stoops to trace
The parlour splendours of that festive place;
The whitewashed wall, the nicely sanded floor;
The varnished clock that ticked behind the door;
The chest contrived a double debt to pay,
A bed by night, a chest of drawers by day;
The pictures placed for ornament and use;
The twelve good rules, the royal game of goose;
The hearth, except when winter chilled the day,
With aspen boughs and flowers and fennel gay;
While broken teacups, wisely kept for show,
Ranged o'er the chimney, glistened in a row.

Vain transitory splendours! could not all
Reprieve the tottering mansion from its fall?
Obscure, it sinks; nor shall it more impart
An hour's importance to the poor man's heart;

. . . . . .

SONNET

This beautiful love sonnet was one of the many Sonnets from the Portuguese, written by Elizabeth Barrett Browning. They were dedicated to her husband, Robert Browning.

HOW do I love thee? Let me count the ways.
I love thee to the depth and breadth and height
My soul can reach, when feeling out of sight
For the ends of Being and ideal Grace.
I love thee to the level of everyday's
Most quiet need, by sun and candle-light.
I love thee freely, as men strive for Right;
I love thee purely, as they turn from Praise.
I love thee with the passion put to use
In my old griefs, and with my childhood's faith.
I love thee with a love I seemed to lose
With my lost saints,—I love thee with the breath,
Smiles, tears, of all my life!—and, if God choose,
I shall but love thee better after death.

ST. JOHN THE BAPTIST

Arthur O'Shaughnessy was an Irishman who was born in London in 1844 and died in 1881. The biblical references in this noble poem on Saint John the Baptist will not puzzle the young reader of Bible stories. Elias, of course, is another form of Elijah, and the last lines refer to the prophet speaking with God in Mount Horeb.

I THINK he had not heard of the far towns;
Nor of the deeds of men, nor of kings' crowns;
Before the thought of God took hold of him,
As he was sitting, dreaming in the calm
Of one first noon, upon the desert's rim,
Beneath the tall, fair shadows of the palm,
All overcome with some strange inward balm.

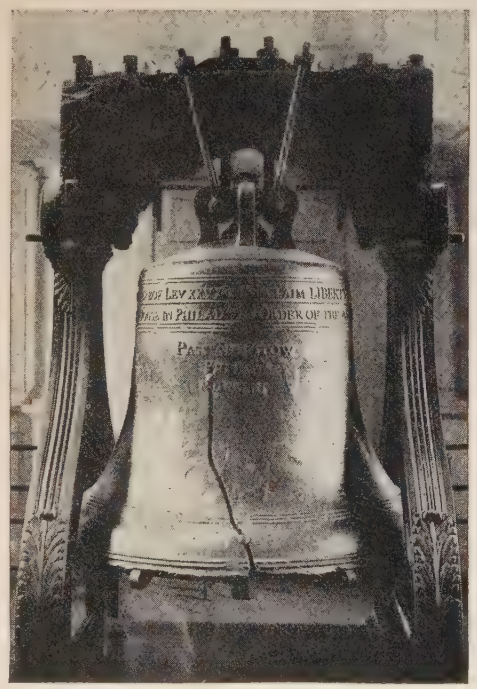
He numbered not the changes of the year,
The days, the nights, and he forgot all fear
Of death. Each day he thought there should have been
A shining ladder set for him to climb
Athwart some opening in the heavens, e'en
To God's eternity, and see, sublime,
His face whose shadow passing fills all time.

But he walked through the ancient wilderness.
Oh, there the prints of feet were numberless
And holy all about him! And quite plain
He saw each spot an angel, silvershod,
Had lit upon; where Jacob, too, had lain.
The place seemed fresh, and bright, and lately trod;
A long track showed where Enoch walked with God.

And often, while the sacred darkness trailed
Along the mountains smitten and unveiled
By rending lightnings,—over all the noise
Of thunders and the earth that quaked and bowed
From its foundations—he could hear the voice
Of great Elias, prophesying loud
To Him whose face was covered by a cloud.

INDEPENDENCE BELL

THIS bell was ordered for the new State House of Pennsylvania and arrived from England in 1752. It cracked before it was hung and was twice recast in Philadelphia. When the Declaration of Independence was read to the people July 8, 1776, the bell was rung before and after. Just fifty-nine years afterward, July 8, 1835, it cracked while tolling during the funeral solemnities for Chief Justice Marshall. The Liberty Bell has become a beloved symbol of American patriotism and has made several trips to different parts of the United States. Placed carefully in a car especially built for it, and with a guard of honor, it made its last trip to the Panama-Pacific Exposition at San Francisco in 1915. At every town or city at which the train stopped, all the children from the schools were taken to see this treasured relic, which links the great nation of to-day with the thirteen feeble colonies of 1776. It now hangs in the hall of the old State House in Philadelphia, where visitors come to see it from all over the United States. On its side are inscribed the words, "Proclaim Liberty throughout the Land to all the Inhabitants thereof." From these facts it is plain that the poem below is not correct historically, but the verses are stirring.



THERE was a tumult in the city,
  In the quaint old Quaker town,
And the streets were rife with people
  Pacing restless up and down,—
People gathering at corners,
  Where they whispered each to each
And the sweat stood on their temples
  With the earnestness of speech.

As the bleak Atlantic currents
  Lash the wild Newfoundland shore,
So they beat against the State House,
  So they surged against the door;
And the mingling of their voices
  Made a harmony profound,
Till the quiet street of Chestnut
  Was turbulent with sound.

"Will they do it?" "Dare they do it?"
  "Who is speaking?" "What's the news?"
"What of Adams?" "What of Sherman?"
  "Oh, God grant they won't refuse!"
"Make some way, there!" "Let me nearer!"
  "I am stifling!" "Stifle, then!
When a nation's life's at hazard,
  We've no time to think of men."

So they beat against the portal,
  Man and woman, maid and child,
And the July sun in heaven
  On the scene looked down and smiled;
The same sun that saw the Spartan
  Shed his patriot blood in vain,
Now beheld the soul of freedom,
  All unconquered, rise again.

See! See! The dense crowd quivers
  Through all its lengthy line,
As the boy beside the portal
  Looks forth to give the sign,
With his little hands uplifted
  Breezes dallying with his hair,
Hark! with deep, clear intonation,
  Breaks his young voice on the air.

Hushed the people's swelling murmur,
  List the boy's exultant cry!
"Ring!" he shouts, "Ring, Grandpa!
  Ring! Oh! ring for Liberty!"
Quickly at the given signal
  The bell-man lifts his hand,
Forth he sends the good news, making
  Iron music through the land.

How they shouted! What rejoicing!
  How the old bell shook the air,
Till the clang of freedom ruffled
  The calmly gliding Delaware!
How the bonfires and the torches
  Lighted up the night's repose,
And from the flames, like fabled Phœnix,
  Our glorious Liberty arose!

That old State House bell is silent,
  Hushed is now its clamorous tongue,
But the spirit it awakened
  Still is living, ever young,
And when we greet the smiling sunlight
  On the Fourth of each July,
We will ne'er forget the bell-man
  Who, betwixt the earth and sky,
Rang out loudly, "Independence,"
  Which, please God, shall never die!

PAUL REVERE'S RIDE

Among the Tales of a Wayside Inn by Longfellow is the story told by the Landlord concerning the ride that Paul Revere took to Lexington and Concord to warn the people of the approach of the English troops.

LISTEN, my children, and you shall hear
Of the midnight ride of Paul Revere,
On the eighteenth of April, in Seventy-five;
Hardly a man is now alive
Who remembers that famous day and year.

He said to his friend, "If the British march
By land or sea from the town to-night,
Hang a lantern aloft in the belfry-arch
Of the North Church tower as a signal light,—
One, if by land, and two, if by sea;
And I on the opposite shore will be
Ready to ride and spread the alarm
Through every Middlesex village and farm,
For the country-folk to be up and to arm."

Then he said "Good night!" and with muffled oar
Silently rowed to the Charlestown shore,
Just as the moon rose over the bay,
Where swinging wide at her moorings lay
The Somerset, British man-of-war;
A phantom-ship, with each mast and spar
Across the moon like a prison-bar,
And a huge black hulk, that was magnified
By its own reflection in the tide.

Meanwhile, his friend, through alley and street,
Wanders and watches with eager ears,
Till in the silence around him he hears
The muster of men at the barrack-door,
The sound of arms, and the tramp of feet,
And the measured tread of the grenadiers,
Marching down to their boats on the shore.

Then he climbed to the tower of the Old North Church,
By the wooden stairs, with stealthy tread,
To the belfry-chamber overhead,
And startled the pigeons from their perch
On the sombre rafters, that round him made
Masses and moving shapes of shade,—
By the trembling ladder, steep and tall,
To the highest window in the wall,
Where he paused to listen and look down
A moment on the roofs of the town,
And the moonlight flowing over all.

Beneath, in the churchyard, lay the dead,
In their night-encampment on the hill,
Wrapped in silence so deep and still
That he could hear, like a sentinel's tread,
The watchful night-wind, as it went
Creeping along from tent to tent,
And seeming to whisper, "All is well!"
A moment only he feels the spell
Of the place and the hour, and the secret dread
Of the lonely belfry and the dead;
For suddenly all his thoughts are bent
On a shadowy something far away,
Where the river widens to meet the bay,—
A line of black that bends and floats
On the rising tide, like a bridge of boats.

Meanwhile, impatient to mount and ride,
Booted and spurred, with a heavy stride
On the opposite shore walked Paul Revere.
Now he patted his horse's side,
Now gazed at the landscape far and near,
Then, impetuous, stamped the earth,
And turned and tightened his saddle-girth;
But mostly he watched with eager search
The belfry-tower of the Old North Church,
As it rose above the graves on the hill,
Lonely and spectral and sombre and still.
And lo! as he looks, on the belfry's height
A glimmer, and then a gleam of light!
He springs to the saddle, the bridle he turns,
But lingers, and gazes, till full on his sight
A second lamp in the belfry burns!

A hurry of hoofs in a village street,
A shape in the moonlight, a bulk in the dark,
And beneath, from the pebbles, in passing, a spark
Struck out by a steed flying fearless and fleet:
That was all! And yet, through the gloom and the light
The fate of a nation was riding that night;
And the spark struck out by that steed in his flight
Kindled the land into flames with its heat.

He has left the village and mounted the steep,
And beneath him, tranquil and broad and deep,
Is the Mystic, meeting the ocean tides;
And under the alders, that skirt its edge,
Now soft on the sand, now loud on the ledge,
Is heard the tramp of his steed as he rides.

It was twelve by the village clock
When he crossed the bridge into Medford town.
He heard the crowing of the cock,
And the barking of the farmer's dog,
And felt the damp of the river fog,
That rises after the sun goes down.

It was one by the village clock,
When he galloped into Lexington.
He saw the gilded weathercock
Swim in the moonlight as he passed,
And the meeting-house windows, blank and bare,
Gaze at him with a spectral glare,
As if they already stood aghast
At the bloody work they would look upon.

It was two by the village clock,
When he came to the bridge in Concord town.
He heard the bleating of the flock,
And the twitter of birds among the trees,
And felt the breath of the morning breeze
Blowing over the meadows brown.
And one was safe and asleep in his bed
Who at the bridge would be first to fall,
Who that day would be lying dead,
Pierced by a British musket-ball.

You know the rest. In the books you have read
How the British Regulars fired and fled,—
How the farmers gave them ball for ball,
From behind each fence and farmyard wall,
Chasing the Redcoats down the lane,
Then crossing the fields to emerge again
Under the trees at the turn of the road,
And only pausing to fire and load.

So through the night rode Paul Revere;
And so through the night went his cry of alarm
To every Middlesex village and farm,—
A cry of defiance and not of fear,
A voice in the darkness, a knock at the door,
And a word that shall echo forevermore!
For, borne on the night-wind of the Past,
Through all our history, to the last,
In the hour of darkness and peril and need,
The people will waken and listen to hear
The hurrying hoof-beats of that steed,
And the midnight message of Paul Revere.

THE NATURALIZED ALIEN

Every year a great many immigrants come across the ocean, to settle in the New World and soon become naturalized and loyal citizens. This poem by Lurana Sheldon shows the patriotic spirit of one who has learned to love his new country and the freedom and liberty for which its flag stands.

THE land I claim claims me!
It holds me sacredly its own, and I
For its best welfare will both fight and die
If such a sacrifice shall be
Part of the great necessity.

The land I claim has made
My chance for victory, for strong success.
In other climes my triumph would be less,
For here has freedom truly laid
Each open path of honest trade.

The land I claim has left
My hands unbound, my will at peace.
Rich are the blessings, precious the release,
From chains whose links were cleft
Ere hope my soul bereft.

The land I claim claims me,
And she shall find her foster-soldier true
To this her flag, the red, the white, the blue,
Though kith and kin shall cross the sea
To call me back to loyalty.

FLAG DAY*

Though this little poem was written for the children of the United States, it is quite as true of Canada. With the change of a word or two it could be recited by a Canadian child who loves his or her flag. This poem was written by Minna Irving.

THE flag—it stands for hearth and home,
For life and liberty,
Prosperity upon the land,
And safety on the sea.
From every fold, immortal souls
Of countless heroes call;
It represents the truest, best,
And bravest in us all.

The flag—the nation rises up
From coast to coast to-day,
Saluting reverentially
Its colors bright and gay.
Beneath its stars the slave is free,
The starving ones are fed,
The weary exile finds at last
A shelter and a bed.

The flag—from old Nantucket's light
To Yukon's furthest crag,
We'll live for it and die for it,
Our great and glorious flag.
We'll cherish it until the breath
Of life from us departs,
For every day, the year around,
It's Flag Day in our hearts.

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WHEN THE CALL IS SOUNDED

The thrill of martial music is felt in this poem by Lurana Sheldon, the author of many poems which have been published in magazines and newspapers. It tells how the soldiers "from hill and valley, from mountain and plain," hasten to rally around the flag when they hear the bugle call summoning them to duty.

THEY will come from the hill and the valley;
They will come from the mountain and plain;
From the deeps and the heights they will rally
At the sound of the bugle's refrain.
They will come in their youth and their beauty
With valorous daring and skill,
And all will be patriot duty,
And all will be patriot will.

Not once will the echo, repeating,
Ring emptily over the plain,
But, swelled with the voices of greeting,
Redouble the clarion strain.
From hearths that are shadowed with sorrow,
From homes that are happy and gay,
They will come at the summons to-morrow
To march to the beat of the fray.

The day when the war-cry is sounded
Not one will show vestige of fear,
But numbers in haste will be rounded
And all will be courage and cheer.
They will come from the mountain and valley,
A noble, invincible band,
To the Flag of the Free they will rally—
The Flag of their own Native Land!

THE FLAG

WHEN you see that flag of beauty,
Do you feel the call of duty?
Do you hear the bugle sounding in your heart?
When you see its colors blowing,
Does it set your spirit glowing
For your country, make you strong to do your part?
That Freedom may not perish
From the land that Freemen cherish,
Do your part!

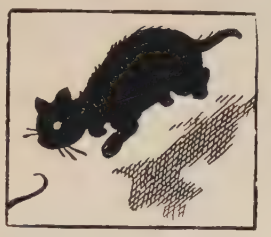
—ANONYMOUS.

THE HOUSE THAT JACK BUILT

THIS is the house
that Jack built.

THIS is the
malt
that lay
in the
house
that Jack built.

THIS is the rat that ate the
malt
That lay in the house that
Jack built.



THIS is the cat
that killed the
rat that ate the
malt
That lay in the
house that
Jack built.

THIS is the dog
that worried
the cat
That killed the rat
that ate the
malt
That lay in the
house that Jack
built.

THIS is the cow
with the crum-
pled horn
That tossed the
dog that worried
the cat
That killed the
rat that ate the
malt
That lay in the house that Jack built.

THIS is the
maiden all
forlorn
That milked the
cow with the
crumpled horn
That tossed the dog
that worried the
cat
That killed the rat that ate the malt
That lay in the house that Jack built.

THIS is the man
all tattered and
torn
That kissed the
maiden all forlorn
That milked the
cow with the
crumpled horn
That tossed the dog that worried the cat
That killed the rat that ate the malt
That lay in the house that Jack built.

THIS is the priest all shaven and shorn
That married the man all tattered
and torn
That kissed the
maiden all forlorn
That milked the
cow with the
crumpled horn
That tossed the dog
that worried the cat
That killed the rat that ate the malt
That lay in the house that Jack built.

THIS is the cock that crowed in the
morn
That wakened the priest all
shaven and shorn
That married the man all
tattered and torn
That kissed the maiden all forlorn
That milked the cow with the crumpled
horn
That tossed the dog that worried the cat
That killed the rat that ate the malt
That lay in the house that Jack built.

THIS is the farmer sowing the corn
That kept the cock that crowed in
the morn
That wakened the priest all shaven and
shorn
That married the man all tattered and
torn
That kissed the maiden all forlorn

That milked the cow with the crumpled
horn
That tossed the dog that worried the cat
That killed the rat that ate the malt
That lay in the house that Jack built.

LITTLE VERSES FOR VERY LITTLE PEOPLE

THERE was an owl lived in an oak:
Whiskey, whaskey, weedle!
And all the words he ever spoke
Were "Fiddle, faddle, feedle!"

A gunner chanced to come that road:
Whiskey, whaskey, weedle!
Says he, "I'll shoot you, silly bird!
So fiddle, faddle, feedle!"

ONE, I love; two, I love;
Three, I love, I say;
Four, I love with all my heart;
Five, I cast away;
Six, he loves; seven, she loves;
Eight, both love;
Nine, he comes; ten, he tarries;
Eleven, he courts; and twelve, he marries.

THERE was an old woman called
Nothing-at-all,
Who rejoiced in a dwelling exceedingly
small;
A man stretched his mouth to its utmost
extent,
And down at one gulp house and old
woman went.

BOW-WOW, says the dog;
Mew-mew, says the cat;
Grunt, grunt, goes the hog;
And squeak, goes the rat.

Chirp, chirp, says the sparrow;
Caw, caw, says the crow;
Quack, quack, says the duck;
And what cuckoos say, you know.

So, with sparrows and cuckoos,
With rats and with dogs,
With ducks and with crows,
With cats and with hogs,

A fine song I have made,
To please you, my dear;
And if it's well sung,
'Twill be charming to hear.

BOBBY SHAFT is gone to sea,
With silver buckles at his knee;
When he'll come home he'll marry me,
Pretty Bobby Shaft!

Bobby Shaft is fat and fair,
Combing down his yellow hair;
He's my love for evermore,
Pretty Bobby Shaft!

HO, my kitten, a kitten,
And ho, my kitten, my deary!
Such a sweet pet as this
Was neither far nor neary.
Here we go up, up, up,
Here we go down, down, down;
Here we go backwards and forwards,
And here we go round, round, round.

OH, who is so merry, so merry, heigh
ho!
As the light-hearted fairy, heigh ho, heigh
ho?
He dances and sings
To the sound of his wings,
With a hey, and a heigh, and a ho!
Oh, who is so merry, so merry, heigh ho!
As the light-hearted fairy, heigh ho, heigh
ho?
His nectar he sips
From a primrose's lips,
With a hey, and a heigh, and a ho!

THE dove says "Coo, coo, what shall I
do?
I can scarce maintain two."
"Pooh, pooh!" says the wren, "I have got
ten,
And keep them all like gentlemen."

DAINTY, diddlety, my mammy's maid,
She stole oranges, I am afraid.
Some in her pocket, some in her sleeve,
She stole oranges, I do believe.

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